INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

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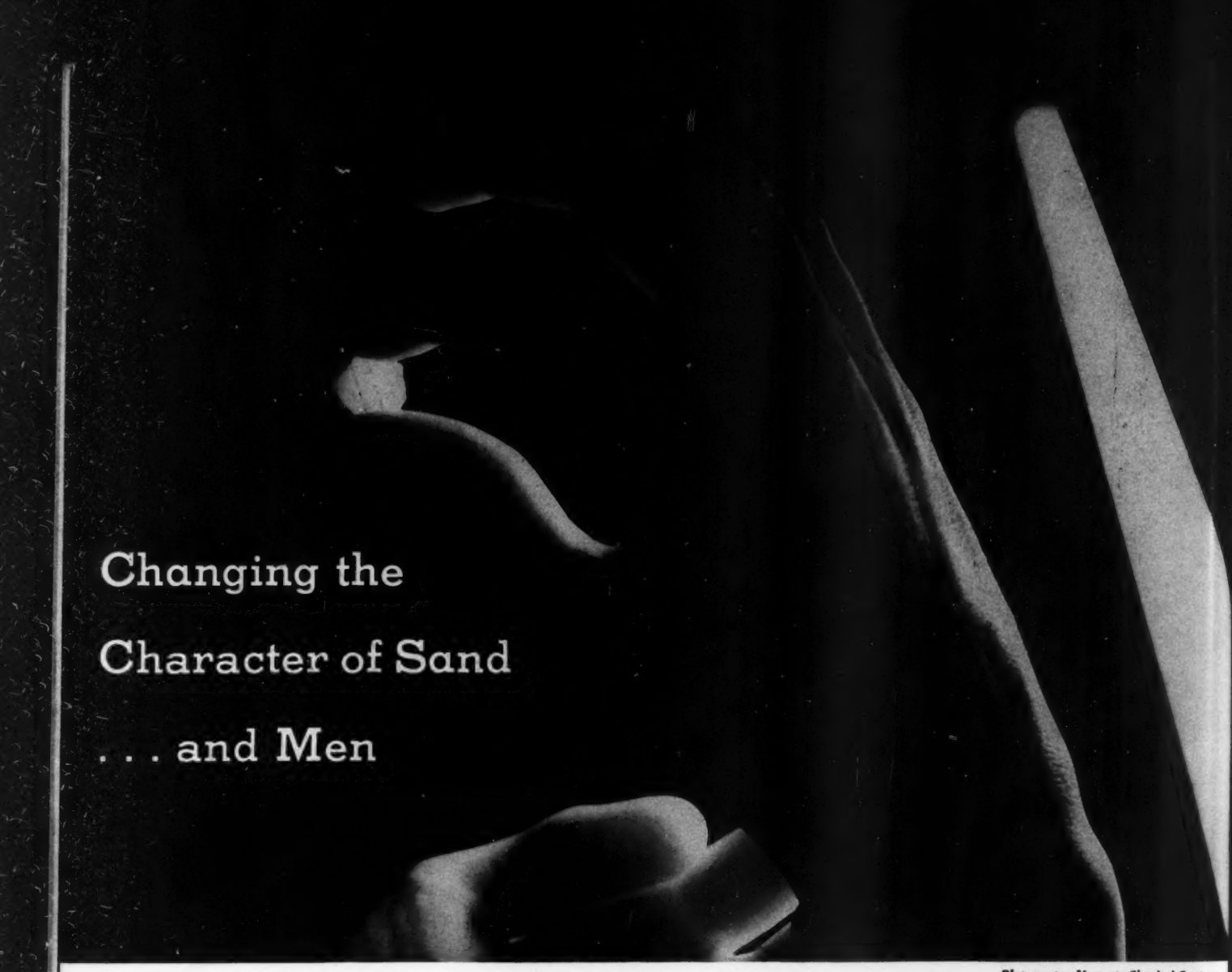
THE SHOP TEACHERS' PROFESSIONAL MAGAZINE

MAY, 1943

VOL. 32, No. 5

MAY REQUISITION NUMBER



Changing the Character of Sand . . . and Men

Photo courtesy Monsanto Chemical Company

NOT too long ago, if anybody had said: "I saw sand bouncing about like a rubber ball, and then I saw sand that flattens out like pancake batter, and then I saw sand that disappears like smoke in the air," his listeners would have replied: "You don't know what you are talking about."

But that just goes to show you never can tell. For science has been at work on sand, and out of the laboratory has come a marvelous new product technically called silica aerogel and commercially Santocel. What it is is simply *puffed sand*, white ocean sand "blown up" to many times its former size, capable of doing all the mysterious things mentioned before and serving commercially in many marvelous ways, among them as a remarkable insulating agent used in quick-freeze processes and as a lightweight flatting agent in airplane camouflage.

Again and again and again it has happened: marvelous results obtained with familiar things . . . provided only that the right treatment and the right influences are used in shaping these familiar things. Most marvelous of all is what can be done with men when the right treatment is accorded them . . . when the proper influences are brought to bear on them during their formative years.

It can be said that in basic mental and physical equipment there is little difference between human beings. Certainly not enough to explain the *tremendous* difference between their achievements. For the explanation of *that*, we must look to the differences in influences and environment. Psychologists know this, and educators are constantly striving to lift the level of influences so that the abilities that so unquestionably reside in *all* children may be freed and developed.

The drawing instruments a boy uses in his mechanical drawing classes can very well be one of these liberating influences. Drawing instruments are likely to be the first instruments in precise thinking, judgment and workmanship the youngster has ever used. They often represent his introduction to the realm where boyish flights of fancy are harnessed to the practical means of achievement, that realm where dream and reality first are joined. Here are instruments that help him to set standards, to distinguish between shoddy workmanship and ideals and good. To say that his boyish fancy can be stirred, captured and made creative by drawing instruments that are cheaply made, carelessly chosen, held in light esteem by his instructor is to deny all the known facts of psychology. Let *these* instruments of creation be chosen carefully, let *them* be the best the boy can afford.

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DIETZGEN

EVERYTHING FOR DRAFTING AND SURVEYING

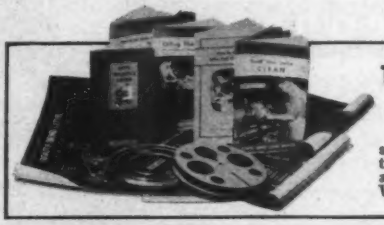
Your Requirements vs. NATIONAL SECURITY

● The demand for Dietzgen Drawing Instruments today greatly exceeds the present available supply. First, the national wartime requirements are making a tremendous demand on our production capacity. Second, the critical materials used in making Dietzgen quality instruments impose a drastic limitation on production for other than the needs of our armed forces and essential war production. Your tolerant understanding of this situation is appreciated.

INDUSTRY NEEDS OPERATORS TRAINED ON MODERN MACHINES

One of the most serious problems confronting our war production industries is to find capable operators to man thousands of newly installed machines. The responsibility of preparing men and women to fill these jobs falls largely on the industrial and vocational schools that are prepared to give practical shop training on modern machines—the kind used in industry.

South Bend Lathes are widely used in war production and are therefore especially practical for industrial apprentice training. Features responsible for their popularity in both industrial and school shops include their modern design, dependability, ease of operation, and precision. Our new catalog 100B describing these lathes is now ready. *Write for it!*



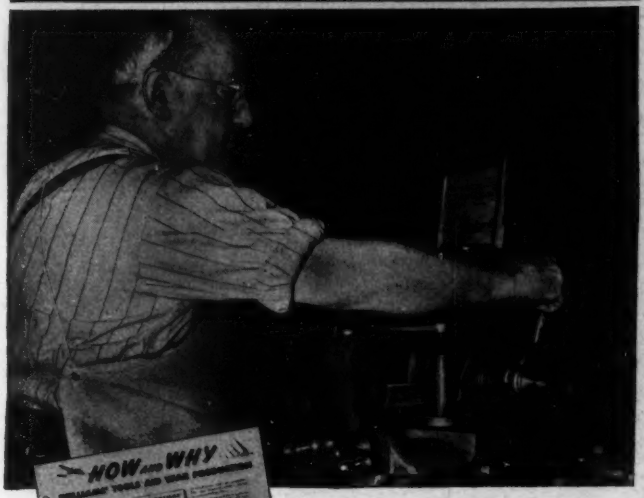
TEACHING HELPS
for Shop Classes

South Bend teaching helps—books, sound films, wall charts, and bulletins on the care and operation of a lathe—are available for school shop instruction. Write for Bulletin No. 21-C.

SOUTH BEND
Precision **LATHES**

SOUTH BEND LATHE WORKS, SOUTH BEND, INDIANA
LATHE BUILDERS FOR 36 YEARS

HOW TO USE WILLIAMS' CUTTING-OFF TOOLS



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WILLIAMS' TOOL DATA SHEETS

● Data Sheet No. 12 tells how to perform one of the most difficult lathe operations by methods that save time and tools. Other data sheets (punched for 3-ring binder) cover subjects listed below. Circle numbers on coupon indicating subjects desired and mail today.

1. Characteristics of Williams' "Superior" Wrenches.
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FOR SMALL-PARTS MACHINING

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MILLING MACHINE

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SHAPER

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Here's a Production Rookie

←LEARNING—

with Black & Decker Tools

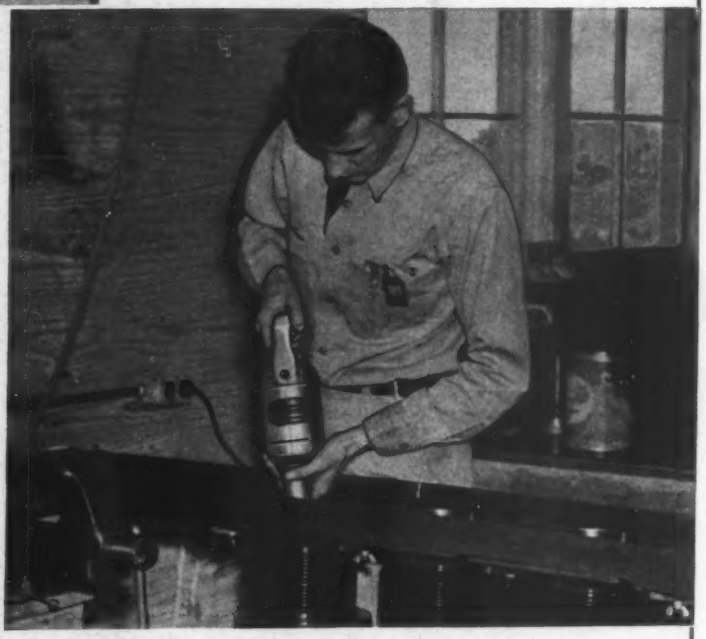
He's typical of America's production rookies now in vocational schools and shops. He's operating a Black & Decker Valve Seat Grinder on a cylinder from a trainer plane engine. He's *learning* early in his career to "get the feel" of the electric tools he'll most likely use when he graduates to war industry.

Here's an Aircraft Mechanic

—EARNING→

with Black & Decker Tools

He's typical of the men in war industry's great production army. He's using a Black & Decker Valve Seat Grinder too, dressing valve seats in an aircraft maintenance shop. He's typical—because he's *earning* with the same electric tools now helping to speed production and maintain other war equipment in *over half the nation's plants today*.



Lessons in Ingenuity—FREE

If you haven't received our new booklet, "They Used Their Heads,"—showing how ingenious war producers have combined brains with B & D Tools to keep vital production rolling—write for your FREE copy today. Teachers will find it especially helpful and informative. Address: The Black & Decker Mfg. Co., 780 Pennsylvania Ave., Towson, Md.

That's why many industrial schools and shops standardize on Black & Decker electric tool equipment. Students are most likely to find them in the plant or shop to which they graduate, so it pays to have them *learn* with the tools on which they'll probably *earn* later. Get in touch with your Black & Decker Distributor for help in selecting the right tools for your training program.

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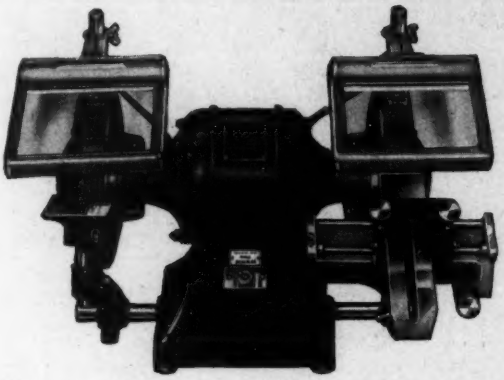
PORTABLE ELECTRIC **TOOLS**

RIGHT GRINDING EQUIPMENT



THE STANLEY No. 677 GRINDER

A *safe* edge tool grinder especially designed for school shops. Makes it easy to teach proper grinding of Plane Irons and Chisels.

Equipped with 1725 R.P.M. heavy duty fully enclosed motor, dust sealed ball bearings, guarded wheels, plane iron and chisel grinding fixture, "FLUD-LITE" Safety Eye Shields. Write for specifications.

. . . for your present Tool Grinders . . .

Assures effective eye protection, better vision, and improved work. Two light bulbs with reflectors flood-light the work, provide *30% more visibility.*

Adjustable, to suit operator's position . . . cannot be moved to non-guarding position. Can be attached to any grinder equipped with wheel guards. Ask your Stanley distributor, or write for details.

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EDUCATIONAL DEPARTMENT, STANLEY ELECTRIC TOOL DIVISION
THE STANLEY WORKS, NEW BRITAIN, CONN.

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Teach with the tools actually used in industry.

With ARMSTRONG TOOL HOLDERS—used in over 96% of the Machine Shops and Tool Rooms. Develop "tool sense" and a love for fine tools with ARMSTRONG Drop Forged WRENCHES—Carbon and Chrome-Vanadium Steel Open End Wrenches; Box Socket and Detachable Socket Wrenches with improved designs, better balance, finer machining and finish. Set up jobs with modern, safe ARMSTRONG Drop Forged Setting-Up Tools. Use ARMSTRONG Drop Forged Clamps that never slip, spring or spread, and ARMSTRONG Drop Forged Lathe Dogs that are standard everywhere.

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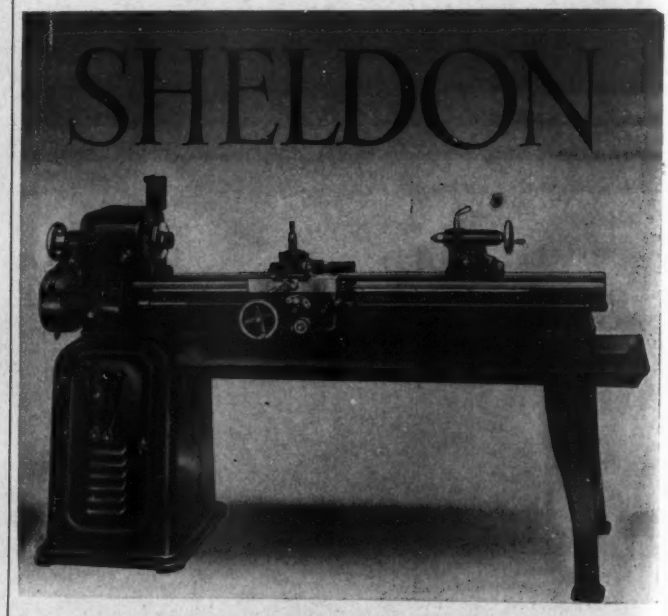

SHELDON BBU-1242 WQ PRECISION LATHE

This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

SHELDON MACHINE COMPANY, INC.
4244 N. Knox Avenue CHICAGO, U. S. A.

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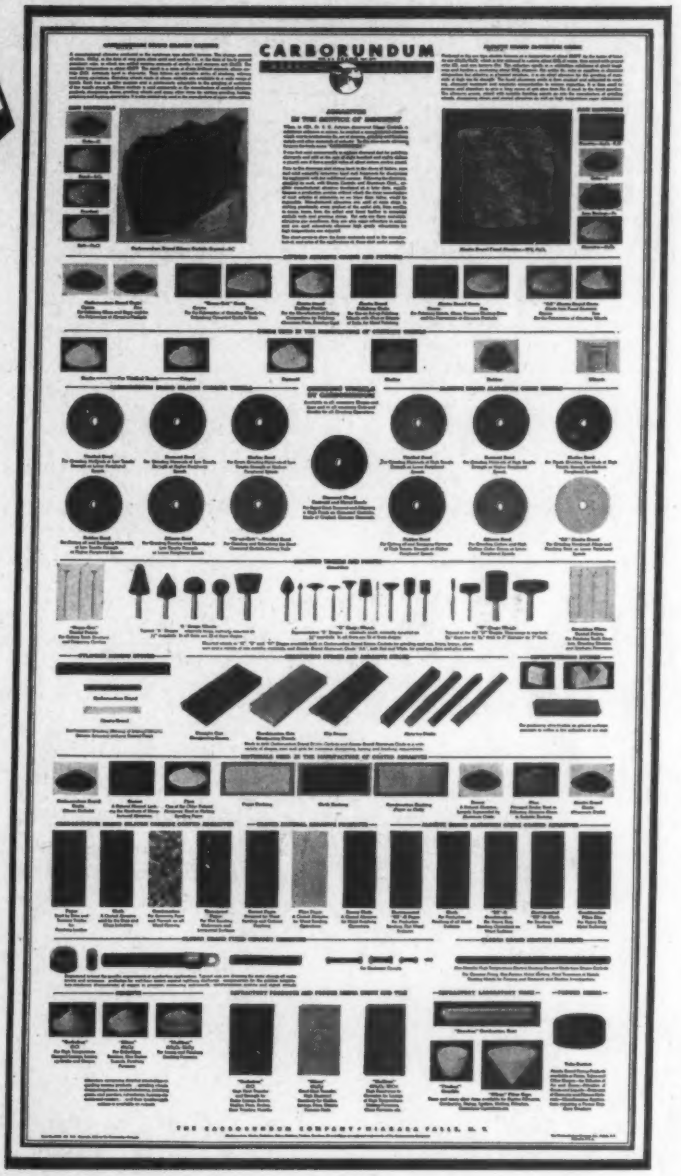

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YOU'RE straining every nerve today to speed up your classes . . . to turn out more trained students *faster!* And this chart was specially designed to help you do just that.

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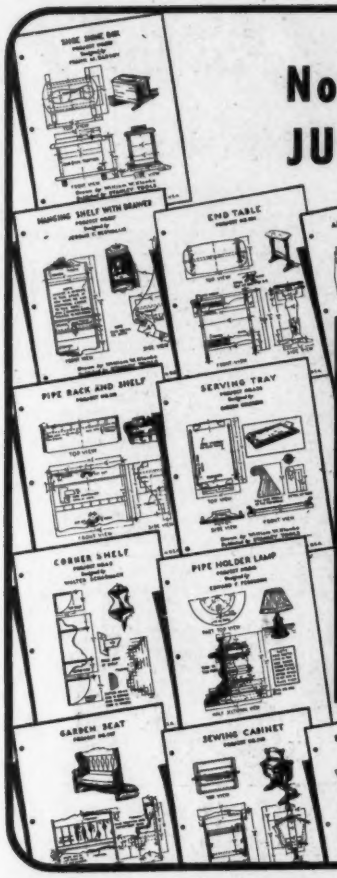
Now 14 Sets of TESTED PROJECT PLANS for JUNIOR and SENIOR HIGH SHOP STUDENTS



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Five plans in each set . . . 70 interesting projects for your students . . . give practice in use of all standard woodworking tools. Designs generally are small in size to economize on wood needed.

Each plan is printed separately on an 8½" x 11" sheet of tough paper. Only 10¢ per set of 5 plans. Select the sets you want and order today. Send coin or stamps.

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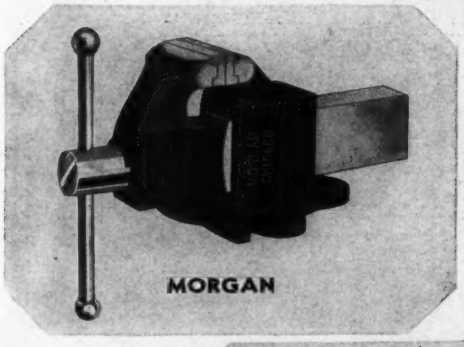

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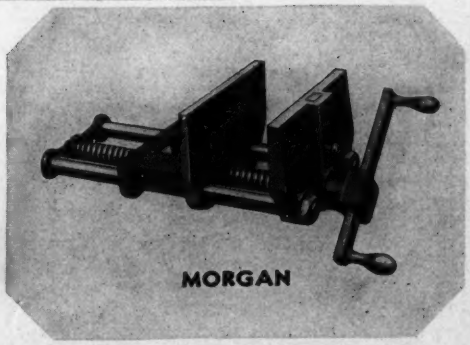
Unsurpassed for strength and durability. Supplied with stationary or swivel base and in various sizes.

CONTINUOUS SCREW AND QUICK ACTION VISE

Designed and built to withstand the most severe service. The extra heavy Cold Rolled Screw and Solid Bronze Nut will last a lifetime.



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Johnson Furnaces

Pot Hardening Furnace No. 575

offers you outstanding features in performance and mechanism. New lid-lifting mechanism easily raises cover and locks it in up position. Heavy 8" insulation is used thruout. Burners, located near top of combustion chamber, insure longer pot life. Tangentially fired around pot, avoiding flame impingement. Vent is provided with damper to regulate flow of exhaust gases. Top ring made in 3 sections to prevent cracking or distortion. Steel pot 14" diameter by 20" deep. $325 F.O.B. Factory. Blower Extra.

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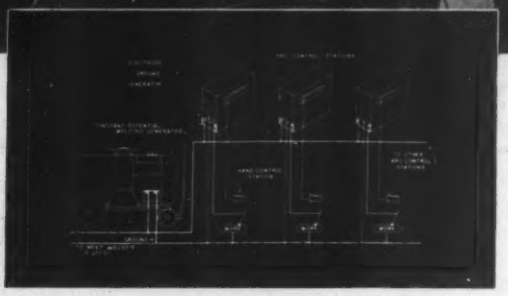
Only the WILSON "Honey Bee"

provides these three timely advantages

1
HELPS TRAIN BETTER ARC WELDERS

2
SHORTENS TRAINING TIME

3
PROVIDES MORE ARCS PER GENERATOR



APT welding students become qualified Army and Navy welders in a remarkably short time when they are trained with a Wilson "Honey Bee." This fact has been repeatedly demonstrated at welding schools throughout the country, and it testifies to the full control and operating simplicity of the "Honey Bee."

Connected in parallel to any constant potential generator, the Wilson "Honey Bee" multiplies the number of arcs from each generator. For example, four 75 amp. or two 150 amp. "Honey Bees" may be operated simultaneously from one 300 amp. constant potential machine. Any generator can be converted quickly to constant potential by making a simple connection.

Each "Honey Bee" station is equipped with both remote arc and crater control. A switch held conveniently in the operator's hand permits him to make infinite adjustments of the welding current, and to fade out the arc gradually to prevent craters and porous welds. Changes in current setting do not affect the performance of other "Honey Bee" stations working from the same generator. For complete information on the Wilson "Honey Bee" mail the attached coupon today.

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Airco 63 Washed Coat Electrode

There's no shortage in the supply of Airco No. 63 electrodes. Perfectly suited for school use, the Airco No. 63 has a light surface coating which improves arc stability and operating characteristics over that of bare electrodes.

Made in 5 sizes from 3/32" to 1/4" diameters, the Airco No. 63 has a tensile strength of 45,000 to 60,000 p.s.i. as welded, and an elongation of 7% to 10% in 2". For prices write to nearest Air Reduction sales office.

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AIRCO WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS! Keep 'em rolling for victory!

FOR PROPER VISE CARE

1 DON'T Hammer the Handle

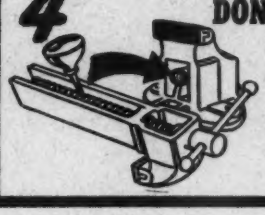
Never hammer the vise handle. Use the leverage of the handles, but never pound to tighten or loosen.

3 DON'T use Handle Extension

Don't use a pipe to extend the handle leverage. That should be unnecessary if the vise is properly designed. Use the normal leverage of the handle.

2 DON'T Hammer the Beam

Don't use the sliding beam as an anvil. It is not made for that.



4 DON'T Forget to Oil the Screw

Use oil or light grease. The latter will last longer. Remove the front jaw to do this. Oil frequently, as the screw will become worn more quickly without lubrication.

This chart, size 15½" x 10" is available for hanging in school shops. Vocational instructors are requested to write at once for their copy. Only a limited supply on hand.

THE COLUMBIAN VISE & MFG. CO.

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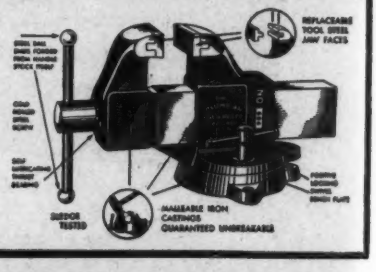

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Automotive - Aviation

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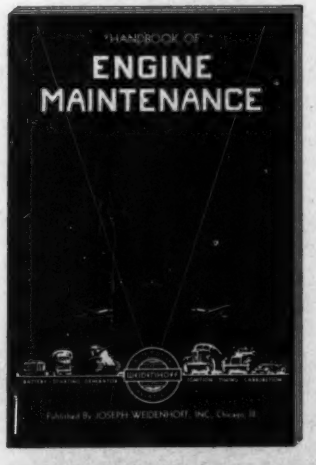
A Practical Book For Pre-Induction Training Courses



Here is a practical treatise dealing with the fundamentals of automotive electricity and allied units, the maintenance of which is vital to good engine performance. The text has been kept simple and many illustrations and diagrams are used.

Subjects covered include automotive electric systems, magnetism and electricity, the ignition system and the high-tension magneto.

Sent free of charge to instructors requesting it on their letterhead. A liberal discount for distribution to students when ordered in quantities of 10 or more.

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Racine Utility Saw
Capacity 6" x 6"
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Includes all features of model shown at right, except cooling system. A low price metal cutting saw for all-around shop use.
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The choice of vocational schools and industry everywhere. Racine Utility Saws include features that make vocational training easy, quick and safe. Their simple hydraulic feed and control are the same as those found in the Racine High Speed Production Saws in use at arsenals, air bases, shipyards and in industry.

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Simple, compact, Hydraulic Unit—easily removable.

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A Modern Source of Hydraulic Force

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KNOW YOUR TOOLS
by MILLERS FALLS

TEN SIZES — lengths from 7" to 24" — comprise the standard Millers Falls line of bench planes. Each serves a special purpose: short models for finishing broad, flat surfaces, reaching into the low spots; jack, fore, and jointer models are progressively longer, for increasing degrees of straight, smooth cutting. Long service life and excellent performance result from three exclusive features: three-point bearing lever cap; solid tool steel cutter; and perfect-fitting cutter cap. Your Millers Falls plane is the product of many man-hours of work, many decades of toolmaking experience. Take care of it . . . treat it as the valuable productive tool it is.

A REVOLUTIONARY development in power hack saws, Blu-Mol "Double-Life" is a high speed molybdenum power blade with teeth on *both* edges. Priced only 50% higher, it delivers *twice* the service of the finest single-edge blades. Used primarily by plants doing large volume of cutting. Typical Millers Falls quality. For hand sawing, use Blu-Mol singles.

18 ELECTRIC drills make up the present Millers Falls line; Model No. 314 (*Illustrated*) is ideally suited to countless jobs in automotive, plumbing, woodworking, heating and ventilating, and general maintenance work. Powerfully motored to sink ¼" holes in mild steel at 2" per min. 110 volts AC or DC. No-load speed 2750 r.p.m. Key chuck. Working parts chrome nickel steel. Lever feed stand makes it an inexpensive, high-performance drill press for home or shop.

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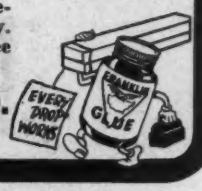
SINCE 1868
MILLERS FALLS COMPANY Greenfield, Mass., U. S. A.

Progressive
TEACHING INCLUDES LIQUID HIDE GLUE

It modernizes your students' training in the same way the motion picture and radio fit into the present-day educational scheme. Franklin Liquid Hide Glue needs no mixing, heating or preparation of any kind. Eliminates chilled joints. It's the glue preferred by the woodworking industry. Write on school letterhead for free sample.



The FRANKLIN GLUE CO.
Columbus, Ohio

BURRILL'S
Paramount Band Saws

Your students should be provided with *BAND SAW BLADES* which have been adopted as being able to stand the stiff requirements of War Production Plants.

Accurately made Band Saws of extreme toughness enables more work to be produced in less man hours.

All sizes are carried in stock for prompt shipment.

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ACCURATELY SPACED TEETH
NO CRUSHED POINTS – GUARANTEED

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ILION, N. Y.

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"We want the same machine tools used in industry"
"Keep them simple in design"
"I need machine tools that can take a beating"

...They Find the Answers in walker-turner MACHINE TOOLS

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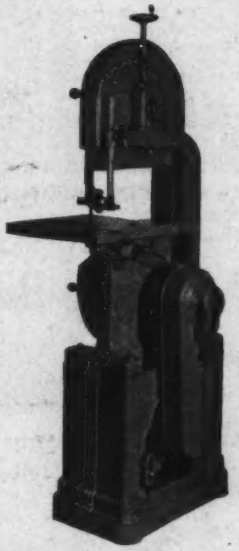
Power or hand feed. Drill to center of 20" circle. Feed 6". Capacity 1" in cast iron, ¾" in steel. Spindle speeds 260-5200 r.p.m.

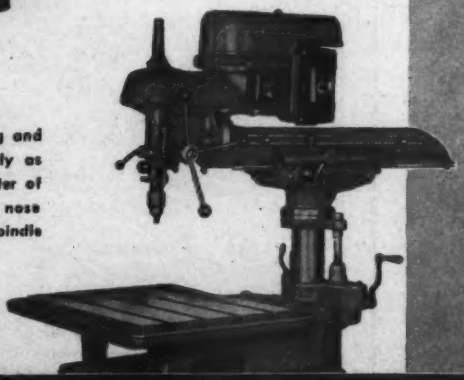


BAND SAWS

14 in. and 16 in. models. Back gearing and cone pulleys provide speed range from 61 to 5300 s.f.m. for cutting practically any material from steel to wood.

RADIAL DRILL

Handles light drilling, tapping and routing operations as effectively as larger machines. Drills to center of 62" circle. Maximum distance nose of chuck to table, 13½". Spindle traverse, 3¾".



Crowded classes, stepped-up schedules and less time for individual instruction call for careful selection of equipment for training purposes. Today—more than ever—you need machine tools that enable the student to learn without having the instructor "sitting on his shoulder" throughout every minute of the school day.

You'll find Walker-Turner Machine Tools the "right" units for this important task because their simplified design and easy operation necessitate less explanation. They stand up under inexperienced handling and are fully safeguarded to prevent accidents. Furthermore, these same Walker-Turner Machine Tools will be used by your students when they "graduate" into industry. Priced to fit school budgets, they are promptly available for war training. Send for new 1943 catalog.

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1933 BERCKMAN STREET, PLAINFIELD, N. J.

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MACHINE TOOLS

DRILL PRESSES — HAND AND POWER FEED • RADIAL DRILLS
METAL-CUTTING BAND SAWS • POLISHING LATHES • FLEXIBLE SHAFT MACHINES
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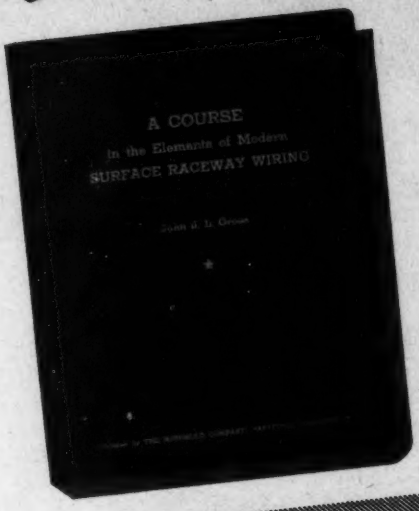
Free to SCHOOLS and INSTRUCTORS



an authoritative COURSE in SURFACE RACEWAY WIRING

In response to many requests, The Wiremold Company has prepared a practical and complete instruction course for electrical wiring with Surface Metal Raceways and Fittings.

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FOLLOWS APPROVED SCHOOL PRACTICES

In preparing this material, The Wiremold Company worked in collaboration with Mr. John J. L. Gross, Instructor in Applied Electricity at the Murrell-Dobbins School in Philadelphia. The course is in full accordance with approved school practices in teaching this subject.

WRITE FOR A FREE COPY OF THE COURSE

Free copies of the course are available, to schools and electrical instructors. Since the material represents a considerable investment in both time and money, we wish to limit the distribution to those vitally interested in it; therefore, we request that your letter be written on your school letterhead, or that it be accompanied by other suitable identification. A nominal price of $2.50 per copy has been set for general distribution.

This material is offered by The Wiremold Company as a free service to vocational and trade schools. We are sure you will find that it is interesting and authoritative, and that it will lend itself to practical application in electrical shop courses.

THE WIREMOLD COMPANY
HARTFORD, CONN.

She's Learning to Make Parts *without* DIES!

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It Pays to Use the Best

All Sizes

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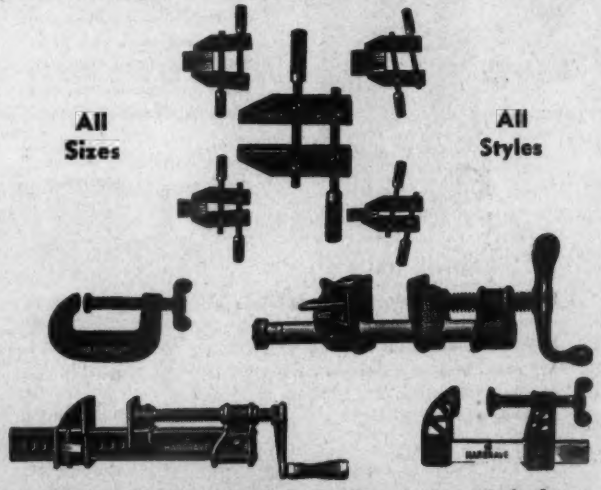


Designed and built to stand the hard every day grind of production work and improved from time to time, with the assistance of some of the largest industrial users. HARGRAVE TESTED CLAMPS have been the leaders in this field since 1879. They cost no more than ordinary clamps.

ASK YOUR SUPPLY HOUSE

CATALOG showing our complete line of Clamps, Chisels, Punches, Bench Anvils, Saw Vises and other tools for the SCHOOL SHOP will be mailed to you upon request.

THE CINCINNATI TOOL CO.
Waverly and Main Aves. Cincinnati, Ohio

Whatever the Job They're Training for . . .

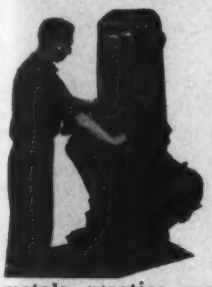
PORTER-CABLE Machines

Make Them More Valuable Workmen

and These Are the Units They'll Use in War Production

Porter-Cable machines get them off to the right start — teach them to work at top efficiency with tools that do jobs the modern way. Look at these various Porter-Cable units — right now in busy use across the country — in aircraft plants, shipyards, munitions factories, wherever America's need is for speed, accuracy and quantity! Then help your students help America by training them the Porter-Cable way — the methods they'll use in actual production!

Porter-Cable G-8 Wet-Dry Belt Surfacer



The modern machining method that gets big production increases — makes substantial cost savings — holds close accuracy — relieves millers, shapers, planers, grinders. Let inexperienced operators do their full share at the start! Utilizes high-speed abrasive belt, either wet or dry. Operations done either freehand or with simple fixtures, works equally well on hard and soft metals, plastics, wood, fibre, hard rubber, ceramics, glass.

Porter-Cable Belt Surfacer Model G-4

With Adjustable Position, (either horizontal or vertical) this model is recommended for finishing small parts. Many light milling and grinding operations done without the use of fixtures. Popular for second operation work. Used in many tool rooms. Slotted table adjustable up to 45°, for machining angled surfaces.

Porter-Cable Belt Surfacer Model B-6

Model B-6 Belt Surfacer is designed for irregular or curved work. Its flexible abrasive belt, wet or dry, follows the contours and produces an even, uniform finish. Adjustable backing plate for flat surfaces.

Porter-Cable 7" Shaper

Alone in its field — the fastest cutting, strongest, most versatile shaper of its size ever developed. Easy operation, speedy set-up and fine precision. It has the weight and rigidity, the flywheel action of the crankpin plate, the wear-saving chain and sprocket drive to handle unusual power and heavier cuts. "Anyspeed" control of ram. You can't find a smoother-running, more chatter-free shaper, nor one that has such a low operational cost.

TAKE-ABOUT the Dustless Sander

Training in Electric sanding is now more important than ever — glider construction, boat-building and other wartime woodworking and plastic jobs require more accurately finished pieces, more skilled workmanship. With Take-About they'll learn faster, easier, finer sanding from a quick-cutting, professional machine. Over 4,000 progressive schools are *now* enthusiastic users of Take-About for the "Craftsman's Touch" — and also for school maintenance jobs.

Speedmatic Saws

You'll find them in common use in military construction, industrial expansion, new housing across the country. They're generally accepted in building and maintenance work. Mechanics want to learn their operation. Speedmatics are noted for their speed, for their 11% greater power efficiency, one-hand operation, true-balanced lightweight, sturdy helical gear drive that give unequalled production.

Speedmatic Floor Sander

For maintenance in schools you can't beat this fast, clean, powerful floor sander. Its balanced high-speed drum, its extra-powered motor, its easy, feel-of-the-floor adjustment, its high-vacuum dust collection, make Speedmatic outperform on even the hardest jobs. A favorite with floor contractors and operators.

NOW. . . send for complete literature on these Important War Production Machines! Check your request and

MAIL COUPON TODAY!

PORTER-CABLE Machine Co.

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Please send me without obligation descriptive matter on Porter-Cable machines indicated below.

- ☐ Wet-Dry Belt Surfacers
- ☐ Take-About Sander
- ☐ Speedmatic Floor Sanders
- ☐ 7-inch Shaper
- ☐ Speedmatic Saws

Firm .....

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NEW TEACHING AID

for the Busy Wartime Instructor

Send Today for FREE WALL CHART ON SAW FITTING

Teaching the proper methods of filing and setting saws is made easier with this new Atkins Wall Chart.

Teachers will find it valuable for general classroom instruction on the proper methods of fitting saws. Pupils will find many occasions to refer to it individually while practicing the various steps involved in preparing saws for best cutting performance.

Illustrations show enlarged views of properly set and filed hand, rip and panel saws. The charts are 19"x 25"... printed on heavy paper... suitable for wall mounting... and are furnished free on request to schools. Send for shop copy today.

E. C. ATKINS AND COMPANY • 404 S. Illinois St., Indianapolis, Indiana

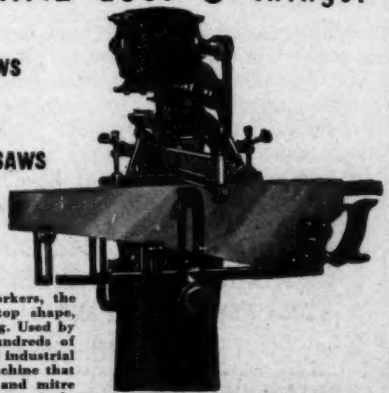
SAW FILING

ONE MACHINE does 3 things:

files **HAND SAWS**

files **CIRCULAR SAWS**

files **BAND SAWS**



For schools training Defense workers, the Foley Filer keeps saws in tip-top shape, faster and better than hand filing. Used by Army, Navy, N.Y.A. Schools, hundreds of manual training departments and industrial plants. The Foley is the only machine that files and joints all hand, back and mitre box saws from 3 to 16 points per inch, cross-cuts circular saws up to 16" diameter (24" optional), and band saws up to 24' long. Patented jointing principle automatically evens up large and small teeth, so saws cut faster, truer, cleaner—stay sharp longer. Foley filed saws have less breakage and last longer.

TYPICAL SCHOOL USERS

Berea College, Berea, Ky.; Board of Education, Cleveland, Ohio; Boys Technical H. S., Milwaukee, Wis.; Q.M. Army War College, Washington; Stout Institute, Menomonie, Wis.

FOLEY AUTOMATIC SAW FILER

FOLEY MFG. CO., 18 Second Street N.E., Minneapolis, Minn.
Please send me booklet and full information on Foley Saw Filer.

Name .....
Address .....
School .....

Now Ready—

—a tested course in wood patternmaking for war time—

Hall's

PRACTICAL WOOD PATTERNMAKING

Gives students and apprentices real preparation for jobs in the quickest possible time. Based on 30 years in the trade and extensive teaching experience. Explains how to read blueprints, correct handling of tools and machines, selection of material, how to use glue, shellac and other materials, how to make cores and core boxes, and how to mold. Includes a wealth of information on care of tools, sandpaper and wood, and trade terms. Provides specific drawings to work from. A complete chapter on safety. Recent advances fully covered. $3.00.

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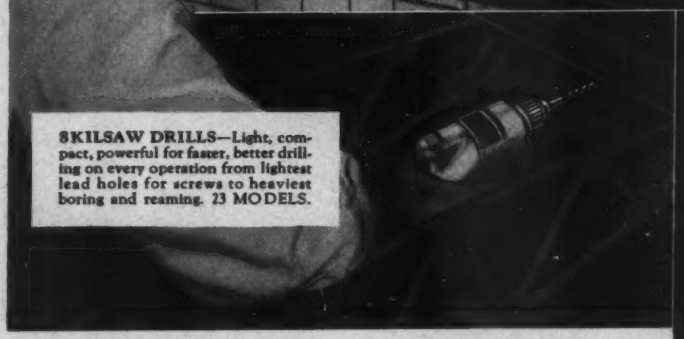
SKILSAW TOOLS

ARE IDEAL FOR INSTRUCTION!



SKILSAW DRILLS—Light, compact, powerful for faster, better drilling on every operation from lightest lead holes for screws to heaviest boring and reaming. 23 MODELS.

SKILSAW DISC SANDERS—Speed up all grinding, filing, metal cleaning, sanding, polishing and buffing on flat or curved surfaces of wood, metals and compositions. 3 MODELS.

SKILSAW BELT SANDERS—For all "final-finishing" on flat surfaces of all materials. Light, perfectly balanced for smooth, even sanding and polishing. Belt widths: 2¼, 3 and 4½ inches. 4 MODELS.

The wise way to train new workers is with industry's own tools and methods . . . *and that means* SKILSAW TOOLS! They're preferred in every field because they work faster, handle easier, get more jobs done in less time. So when your students are already adept with SKILSAW TOOLS, they'll make the shift to real production quicker in aircraft, tank and war material plants everywhere.

SKILSAW TOOLS are more powerful, but since they're lighter and more compact they make learning easier for your classes . . . *and help them do perfect work sooner!* Ask your dealer to demonstrate SKILSAW TOOLS *today!*

SEND FOR THIS FREE CATALOG! *It illustrates every tool in the SKILSAW line. Then ask your dealer to demonstrate these tools on the jobs you teach.*

SKILSAW, INC., 5035A Elston Avenue, Chicago, Ill.

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit • Indianapolis • St. Louis • Kansas City
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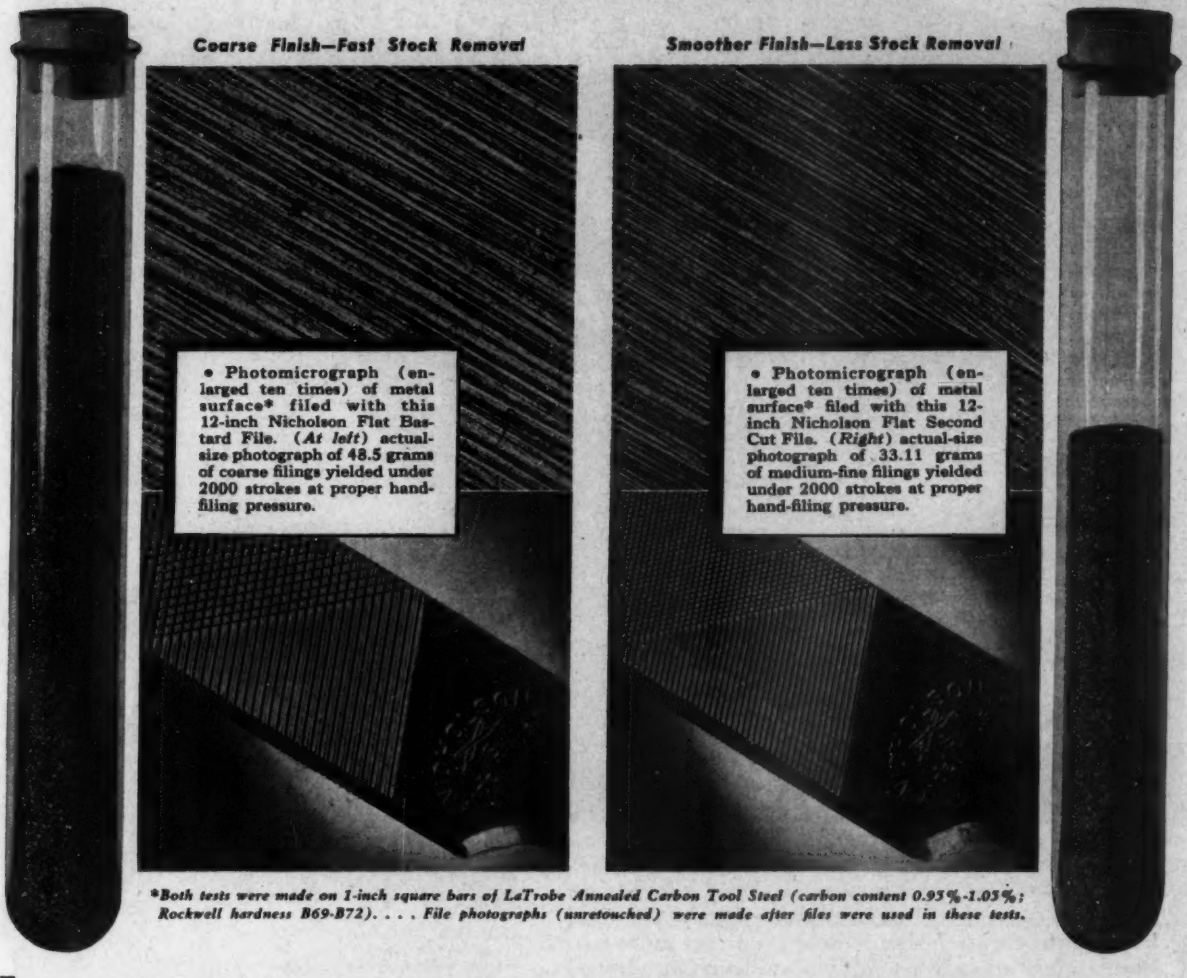
SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

"PHOTO FINISH" with a Big Difference


Coarse Finish—Fast Stock Removal
Smoother Finish—Less Stock Removal
• Photomicrograph (enlarged ten times) of metal surface* filed with this 12-inch Nicholson Flat Bastard File. (At left) actual-size photograph of 48.5 grams of coarse filings yielded under 2000 strokes at proper hand-filing pressure.
• Photomicrograph (enlarged ten times) of metal surface* filed with this 12-inch Nicholson Flat Second Cut File. (Right) actual-size photograph of 33.11 grams of medium-fine filings yielded under 2000 strokes at proper hand-filing pressure.

*Both tests were made on 1-inch square bars of LaTrobe Annealed Carbon Tool Steel (carbon content 0.95%-1.05%; Rockwell hardness B69-B72). . . . File photographs (unretouched) were made after files were used in these tests.

In filing production, skill is important. But the comparative tests photographically illustrated above show clearly that *The right file for the job* is highly important toward making that skill yield its utmost. (The wrong file wastes time, reduces efficiency, produces the wrong finish—and often spoils the work.)

These tests, among many made continually in the Nicholson test laboratory, show the work of two regular Nicholson Machinists' Files used under identical conditions by highly skilled mechanics.

Similar tests with other types and cuts of files will reveal equally interesting comparisons. For classroom exhibits and discussions, many can be made with reasonable accuracy right in the school shop.

What's the job and what's the metal; what's the finish and what's the time the job warrants? Do they call for rapid stock removal, and much or little; for rough, medium or precision results? . . . These are some of the questions which, in these days of specialized production, must be answered with *the right file.*

Here are some especially illuminating comparative tests you can make—with observations, not only as to finish and stock removal, but with regard to wear-and-tear effect on the files themselves:

- Ordinary Flat File vs. Special Stainless Steel File—*on stainless or other hard alloy steel.*
- Ordinary Flat File vs. Special Foundry File—*on rough castings.*
- Ordinary Flat File vs. Special Aluminum "Type A" File—*on bar aluminum or aluminum-alloy castings.*
- Ordinary Flat File vs. Special Brass File—*on brass or bronze.*
- Ordinary Mill File vs. Special Shear Tooth File—*on soft metals or alloys.*

The differences in design and results among these and other comparative files are covered in the new Nicholson book, "*File Filosophy.*" Free to school managements and instructors.

For school-shop practice, Nicholson or Black Diamond Special Purpose Files are obtainable through mill-supply houses—with regular types generally available at hardware stores as well.

WRITE FOR *FREE REPRINTS*
of this ad — a valuable lesson-sheet.

NICHOLSON FILE CO., 47 Acorn St.
Providence, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

VOL. 32 MAY, 1943 Number 5

Requisitions

The question of requisitions is again before us. It is of special importance to give this matter more than usual consideration at this time. Because of conditions, the utmost economy must prevail. Things that in ordinary times would be discarded must now be repaired if that is at all possible.

New equipment in some cases can still be obtained, but war-time priorities make shipment dates a matter of uncertainty. The thing to do then is to get the best possible priority from your WPB representative, and send in your orders early.

Summer School Opportunities

Shop teachers who contemplate attendance at summer school may find assistance in solving their problem by looking up the statements of the following institutions which have appeared in the advertising sections of the March, April, and May issues of INDUSTRIAL ARTS AND VOCATIONAL EDUCATION.

Bradley Polytechnic Institute, Peoria, Ill. Three terms of 30 days each: May 3–June 11; June 14–July 17; and July 19–August 21. Attend one, two, or three terms.

Oregon State College, Corvallis, Ore. First session, June 14–July 20; second session, July 21–August 27. Graduate and undergraduate courses.

The Pennsylvania State College, State College, Pa. Intersession, June 7–June 25. Main summer session, June 28–August 6. Postsession, August 9–August 27. Summer semester, June 7–September 24. Graduate and undergraduate courses.

The Stout Institute, Menomonie, Wis. Summer session, June 21–August 20. Three, six, and nine-week courses.

University of Minnesota, Minneapolis, Minn. First term, June 15–July 24. Second term, June 26–August 28. Graduate and undergraduate courses. Also some three-week courses.

Wayne University, 467 West Hancock, Detroit, Mich. Main session, June 21–August 13. Postsession, August 16–August 27. Graduate and undergraduate courses. Opportunities offered to combine schoolwork with work in war-production plants.

This Month's Cover

The cover picture shows three air-minded students attending one of the industrial-arts laboratory classes of the Chicago public schools' system. Dr. Louis Newkirk, director of the bureau of industrial arts, submitted the picture.

CONTENTS

Naval Training Schools, Great Lake, Illinois, *Lieut. (jg) Nelson Hauer, U.S.N.R.* 183
Summer Employment for Industrial-Education Teachers in Essential War Industries, *Earl L. Bedell* 185
A Supervisor's Viewpoint of Industrial Arts, *Arthur L. Reagh* 186
Problems in Related Instruction, *Benjamin J. Novak* 189
The Success, *Leonard E. Schmidt* 191
Editorials 192
A Method of Teaching Auto Mechanics, *H. C. Seymour* and *Charles Sands* 194
A Course of Study in Distributive Education Based on Job Analysis, *Murray Banks* 198
Teaching Materials for Industrial Education, *Chris H. Groneman* 201

Testing and Tests

Writing Objective Tests for Shop Instruction, *Frank C. Moore* and *William R. Mason* 203
Orthographic Projection — Identification of Planes, Elevations, and Projections, *Harry F. Mergler* 206
Preflight Aviation Test — Unit VI, *Harold Theodore Glenn* 206
Preflight Aviation Test — Unit VII, *Harold Theodore Glenn* 206

Problems and Projects

How to Use a File, *Harold L. Lesher* 207
Bag Holder, *Louis M. Roehl* 207
Wings for the Beginner, *William E. Huss* 208
Arrow Painting Rig, *Allen A. Glisch* 210
Pencil Pointer, *Homer C. Rose* 210
A Bread-Slicing Jig, *G. S. Duncan* 211
The Abrasive Tools of Industry — Part I, *J. E. Donald Hastie* 212
Books Ends, *Delmar W. Olson* and *Walter Troutman* 213
Fisherman's Bait Box, *Norman W. Morgan* and *William B. Evans* 215
Two-Tone Finish on Oak, *Louis F. Barocci* 215
Design for the Teacher of Industrial Arts, *Burl N. Osburn* 217
Camouflage Course, *Richard E. Bailey* 219
Whittling-Jackknife Technique, *W. Ben. Hunt* 222
A Child's Napkin Ring, *F. Clarke Hughes* 20A

Personal News 20A
Association News 25A
News Notes 28A
Shop Equipment News 30A
Answers to Questions 34A
New Publications 36A

Articles Indexed. — The articles contained in the Magazine are regularly indexed in "The Readers' Guide to Periodical Literature," and "Education Index."

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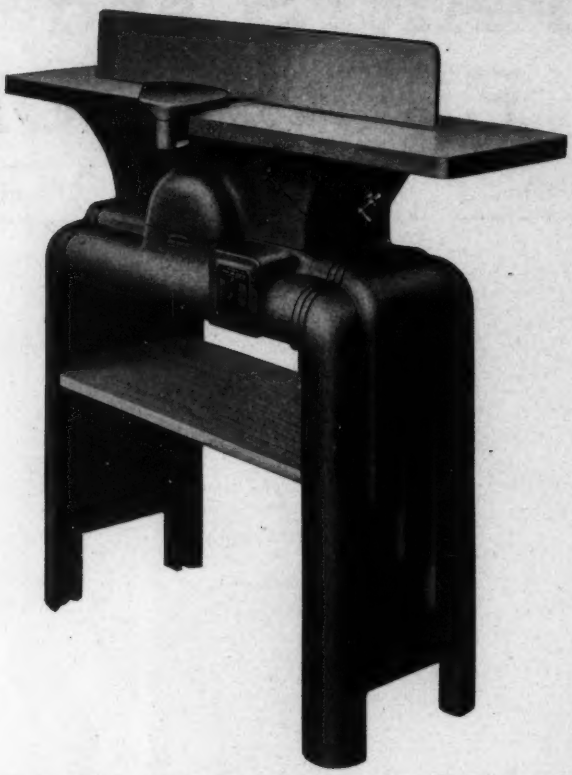
Editorial Contributions. — The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

PUBLISHED MONTHLY, EXCEPT DURING JULY AND AUGUST, BY THE BRUCE PUBLISHING COMPANY, 540 N. MILWAUKEE STREET, MILWAUKEE, WISCONSIN

Eastern Office: 330 W. 42nd. St., New York, N. Y. — Western Office: 66 E. South Water St., Chicago, Ill.

SAFE • HEAVY • STRONG



J-31 JOINTER

VOCATIONAL training classes have expanded tremendously during the past few years, yet due to wartime restrictions, a relatively small amount of new shop equipment has been placed in service. It is not difficult, therefore, to realize how necessary it is to give this equipment the best possible care.

In the case of the J-31 Jointer, the following operating precautions should be observed. Always keep the cutterhead knives sharp. Dull knives not only produce inferior work, but are dangerous as well. The knives should also be set accurately and fastened securely.

It is better to take several light cuts instead of one heavy one, a practice which imposes less strain on the machine and is much safer for the operator. Check the tables and the fence to be sure that they are properly set and locked before starting the machine. Never move the fence while the cutterhead is revolving.

Since this jointer can be moved about, care should be taken to select a level area if its location is changed. It is also advisable to remove occasionally, any dust which might work its way into the motor shell.

The J-31 Jointer is a quality machine, capable of producing the best type of work. It requires only a very small amount of time and effort on your part to keep it operating at its maximum efficiency.

YATES-AMERICAN MACHINE COMPANY • BELOIT, WISCONSIN

Short Talks on Wood

RED ALDER (*Alnus rubra*)

The leading broadleaf tree of the Pacific Northwest. Important in this region because of a scarcity of other hardwoods, but not of much consequence in other parts of the country. The wood is fine-grained, light in weight, moderately strong and shrinks very little. Easily worked. Color varies from white to pink-brown.

The greatest portion of the annual cut is consumed locally in the production of furniture. A small amount is used for millwork, woodenware and novelties.

Grows along the Pacific coast from southern Alaska to southern California, but reaches its best development in Washington and Oregon. Thrives in moist locations, especially along streams. Grows quickly and in dense stands following the removal of conifer forests by logging and fire, but is later crowded out as the hardier species grow in again. Is therefore considered a secondary forest tree.

Ordinarily grows to a height of 40 to 50 feet but may reach 80 to 100 feet under favorable circumstances. Diameter is usually about 10 to 20 inches. In the forest the trunk is quite straight and topped with a narrow pyramidal head. Trees grown in the open are profusely branched.

The smooth, thin, pale gray bark distinguishes it from all other alders. The ovate leaves are 3 to 6 inches long and are notched on the edges. Buds are deep red. Produces an abundant amount of seeds which are carried in little cones, ½ to 1 inch long.

To date, forty-four brief articles similar to the one above and dealing with the more commonly used woods have appeared in these ads. As in the past, we continue to invite your suggestions as to the species of wood you would like featured in this series.

YATES-AMERICAN

INDUSTRIAL ARTS *and* VOCATIONAL EDUCATION

Naval Training Schools, Great Lakes, Illinois

LIEUT. (JG.) NELSON HAUER, U.S.N.R.*

The early sponsors of the Great Lakes Naval Training Station little realized when they selected a site 1000 miles inland that some day it would be the largest station in the world.

Established April, 1904, by an act of Congress, the station consisted of 167 acres on the west shore of Lake Michigan, 30 miles north of Chicago. The original site was donated by the Commercial Club of Chicago and plans were made immediately for a building program which was completed in 1911. The station was then formally opened by President Taft.

It was not until 1918, during World War I, that a real opportunity presented itself to test the facilities of the station. As the Navy increased its wartime strength, demands were made upon the station for training purposes until it expanded to over 1200 acres of land and 950 buildings. At one time, during 1918, the station had a complement of nearly 50,000 men.

Phenomenal as the growth of the station may have seemed in 1918, today the station has developed to a much greater size.

The main purpose of the training at Great Lakes is to prepare men for duties both ashore and afloat. The training consists of indoctrinating new recruits, called *boot training*, and preparing them for specialized jobs. A few of these specialized jobs are as articifers in the skilled trades, such as machinists, metalsmiths, welders, and others, including radiomen, signalmen, and gunners.

Today, a seaman needs to know more than how to trim sails, tie knots, and navigate a vessel. With the passing of the frigate and the sloop as man-of-war vessels, and the introduction of steam propulsion, iron-clad ships, radio, and power-operated guns and turrets, the need for highly trained men is growing in direct proportion to the size of the Navy and "because of attacks from without, we are witnessing not only the greatest expansion that our Navy has ever known, but the greatest expansion that any navy has ever known."[1]

A large part of the training at Great Lakes is devoted to trade school work. The schools are known as service schools, of which there are three groups — (1) electricity — ordnance, (2) communications — clerical, (3) machinists — metalworkers.

Each group trains several kinds of specialists, as indicated in the groups following:

Electricity-Ordnance: electrician's mates, torpedoman's mates, gunner's mates, fire controlmen, aviation ordnancemen.

Communications-Clerical: radiomen, signalmen, yeomen, storekeepers, quartermasters.

Machinists-Metalsmiths: machinist's mates, metalsmiths, boilermakers, molders, ship fitters, carpenters.

*Bureau of Naval Personnel, Arlington Annex, Navy Department, Washington, D. C.

[1]C. N. Smith, "Selection, Training, and Morale of Navy Personnel." The Annals of the American Academy of Political and Social Science, p. 57-66, Vol. 220, March, 1942.

— Official U. S. Navy Photograph

Apprentice seamen receiving training in mechanical drawing and mathematics

All enlistees are eligible to apply for training in the specialized branches of the service. Previous experience at the work is not a prerequisite. However, it is necessary that one have certain qualifications indicating aptitudes for learning. For those who have had previous experience, every opportunity is made available to continue in the work with which they are familiar.

Training to become a specialist begins after the period of *boot training*, a 12-week transition period intended to help the new recruit to make the necessary psychological, physical, and social adjustments from civilian to Navy life.

Then, too, in *boot training* school has begun, for the new recruit, now an apprentice seaman, in the elements of seamanship. Gradually floors become decks, stairs are called ladders, and windows are ports. He learns also how to take care of his clothes and how to make up a hammock. Formation drills and athletics are a large part of the day's schedule in conjunction with the physical conditioning program.

Other features of the educational program in boot training are its guidance and exploratory facilities. The apprentice seaman is given an opportunity to investigate the many branches of service in the Navy, and, in turn, the officers are in position to observe the new recruit and to help make recommendations as to the field of activity for which he is best qualified.

The final selection for training in skilled work or entrance to a service school is based upon three techniques — the interview, classification marks or grades in boot training, and psychological tests. Capacity to learn is the basis for appointment.

The average course for specialist training continues for 16 weeks, 6½ hours daily and for 5½ days weekly. Four full days of each week are devoted to actual shop practice. One-half day is spent in related drawing, sketching, and blueprint reading, and one-half day is spent in the mathematics and science classes. Generally, Saturday meetings are devoted to examinations on the week's work.

— Official U. S. Navy Photograph

A recruit learning how to operate the power lathe

The objectives of the different courses are to provide training and experience that will be of direct benefit to the Navy ashore and afloat — that is, depending whether the specialist is quartered on board ship or in a shore station.

The objectives of a few of the different training programs are as follows:

Machinist Mates: Operate main engines and auxiliary engines on board ship. Adjust, repair, and overhaul engines and other engine equipment. Be familiar with the details of ship's drainage systems, distilling plants, internal combustion engines, evaporators, and pumps.

Metalsmiths: Make plans, time and cost estimates. Work in copper and brass. Repair piping. Draw out, temper, anneal, and caseharden metals. Know arrangements of ship's ventilating systems and duties of damage repair parties. Be able to test watertight doors, ports, and hatches.

Carpenter's Mates: Use hand and power tools to repair or replace all woodwork on board ship. Preserve wood surfaces in all parts of ship. Know various woods used in shipbuilding, how to join and finish them. Take charge of ship ventilation, painting, watertight control, drainage, laying of linoleum. Understand shoring and drydocking.

Signalmen: Stand signal watch on bridge. Send and receive international code by blinker, searchlight, and semaphore. Take and receive flag signals. Identify flags of government departments, naval craft, and foreign ships. Use pelorus and navigator's range finder. Operate searchlights and signal apparatus in darkness. Identify storm warning and distress signals.

Yeomen: Take charge of ship's office. Take dictation, write Navy letters. Prepare reports. Operate duplicating machines. Use Navy filing system. Keep personal records. Type, route, and file correspondence. Handle routine details of enlistments, discharges, transfers, promotions, transportation, and travel. Know benefits available to enlisted men and how to get them.

One of the most interesting camps at the Great Lakes Naval Training Station is the Robert Small Camp for Negroes. There are well over 1000 enlisted men in this camp, and the enlistees come from all parts of the country. Every opportunity to get skilled training and qualify for a rating is given to Negroes.

The education and training of the Negroes before enlisting is comparable to that of the white enlistees, and it is not unusual to find a high school or college graduate in the group.

In the communications school there are over 300 Negroes in training, and it is with no small amount of interest and enthusiasm that they pursue their studies. A random selection of the candidates in the communications school reveals the following experience and educational qualification. Candidate *A* has a B.S. degree. He is from North Carolina and taught school before joining the Navy. Candidate *B* is a high school graduate and has had experience at shoeshining and as a janitor. There is another who taught English in a college and has a M.A. degree. A fourth member had been employed as a post-office clerk in New York City.

While the program for Negroes is still in the experimental stage, it is proving to be very successful with promises of greater expansion.

In all the service schools, for Negroes as

— Official U. S. Navy Photograph

Students at welding, while other recruits are being taught how to climb ship ladders

well as for whites, instruction is given in a manner similar to the usual vocational trade school procedure. Individual instruction is given in so far as it is possible. In the skilled trades shops, unit instruction sheets and job plans are used, supplemented with films, visual aids, textbooks, manuals, and lesson guides.

When the apprentice seaman completes the 16 weeks and passes the qualifying examination, he is eligible for a petty officer rating and assignment to sea duty. The results to date show that all but a very small percentage fail to qualify for a rating. This is partly due to the methods of selecting candidates for special training.

The kind of training given a specialist is of course directed toward usefulness and the needs of the Navy. However, this should not be interpreted to mean that it is the kind of training that may be useful only while the specialist is in the service. In a great many cases, the training will be useful throughout the entire vocational life of the specialist whether he is in or out of the service. For example, the principles of machine-shop practice used by the Navy are little, if any, different from those used in private industry. In reality, a specialist in the Navy is being trained for active military service as well as for vocational life.

Summer Employment for Industrial-Education Teachers in Essential War Industries

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Teachers of industrial-education subjects need industrial experience. Such experience is required in most states for the certification of vocational teachers. At present, instructors have a strong desire to participate directly in the war effort during the vacation months by securing a job in some essential war industry. Most teachers will be eager to secure work that will enable them to further advance their professional training. Industries are willing to employ teachers in many areas during the summer months.

In the Detroit area the following classifications will be open this summer:

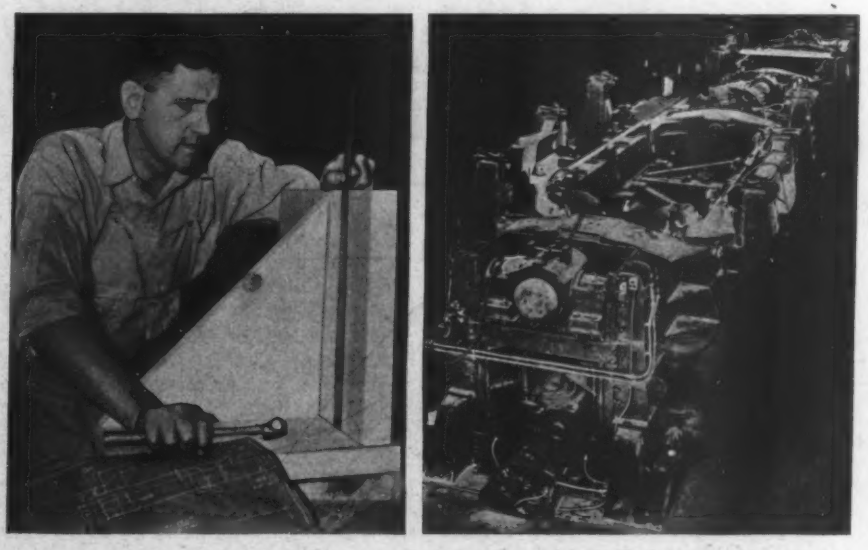
1. Bench metalwork
2. Chemical laboratory
3. Drafting
4. Inspection and testing
5. Machine tool operation
6. Metallurgy and heat treating
7. Patternmaking
8. Plastics
9. Sheet metal and metal forming
10. Welding

It is important to the advancement of our profession that a teacher secure employment in an area directly related to the subjects which he teaches. Teachers of drafting may vitalize their courses by spending the summer in a drafting room in industry. In Detroit, the industries have agreed to provide work experience in an area directly related to the subject to be taught or being taught by the teacher.

Educators in the field of industrial-teacher education should organize courses that are closely allied with work experiences in industry. The very nature of the work done by a shop teacher demands that he bring to his students an appreciation of the problems of labor and industry. Teachers are always eager to further their education by taking college courses during the vacation months. It should be possible for them to take courses this summer that will be closely correlated with work experiences in essential war industries.

Wayne University, Detroit's municipal university, has organized courses in industrial education that are offered at out-of-shift hours. In Detroit, employment managers have indicated that they could best provide work for people on the afternoon shift, which is from 3:00 to 11:00 p.m. University classes are scheduled for people on this shift between the hours of 9:00 a.m. and 1:00 p.m. It is possible for the student to schedule two or three courses at the university during the summer months. These courses are planned so that they are *tied up* with the work experience in industry. For example, a course in "Modern Industrial Processes" is conducted as a weekly conference where the teachers get together and discuss their work experiences in industry. "Educational Programs of Business and Industry in the Community" is a course that provides an opportunity for students to study the educational programs maintained by the industrialists in metropolitan areas. It is imperative that the professional courses taken during the summer be closely integrated with work experiences.

Teachers of industrial-education subjects are expected to provide experiences in their



— Photographs courtesy of Ford Motor Car Company

Patternmakers working in wood are still in demand. The illustration at the right shows an enormous fixture used by General Motors Fisher Body Division in the manufacture of tanks

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classes that will help young people take their places in an industrial society geared to the necessities of the war. By working in war industries and attending school, teachers should be able to cope more intelligently with the problems resulting from:

1. The breakdown of our skilled trades in terms of *pay-roll jobs*.
2. Training programs for women going into industry.
3. Preinduction courses designed to provide the necessary background experiences for young men going into the service.
4. A proper attitude toward labor organizations and labor problems.
5. The changes taking place in industry.

The teacher has added responsibilities during these times of enormous economic and social changes in regard to the development of acceptable work habits and attitudes on the part of his students. When the teacher has an opportunity to rub shoulders and work with people who are confronted with these economic and social problems, he can take back a lot to the school that will help him cope with his teaching problems.

Industrialists have come to recognize the work being done in industrial-education classes during this war as essential and vital to the battle of production. Our advisory committees for the Vocational Training Programs for War Production Workers have functioned diligently and have done a great deal to build up a cooperative relationship between the schools and industry. Men trained in industrial education have been called into key positions to head up training programs within industry. These are only a few of the many recent developments which are paving the way for a cooperative industrial teacher education program between Wayne University and the industries in metropolitan areas.

— Courtesy of General Motors Corporation

This drafting room is typical of many drafting rooms in industry in which public school drafting teachers will be employed this summer

The doors of industry are open this summer to shop teachers who wish to make a contribution to the war effort and at the same time receive valuable work experience which will contribute to their professional growth.

"He profits most who serves best."

A Supervisor's Viewpoint of Industrial Arts

ARTHUR L. REAGH*

The person who is charged with the responsibility of directing a department or a subject within a department should pause now and again to examine his philosophy of the subject and measure results in the light of his belief. This article was written with this viewpoint in mind, and the following is the outgrowth of many periods of cogitation and meditation.

A viewpoint of a subject giving a true picture should include all phases of it. This would mean in this case a definite knowledge of its field, its purpose, and the trends as advocated by the experts in the field.

This article will be an attempt to follow out that program as completely as the space allocated to me will allow. While this is a paper on industrial arts, much of it applies to trade education as well.

In order that we may be properly oriented perhaps a somewhat general definition of the industrial arts will help in a mutual understanding.

The statement that the industrial arts is an area in general education, which meets the needs of the pupils for experiences in the use of materials, tools, equipment and a knowledge of the processes of industry and their social significance to the life of the community, *should be acceptable to all of us*.

It should be emphasized that this is an area not covered by any other phase of general education.

We are not to be confused with vocational education which is definitely purposed for trade training.

It is unfortunate that due to the early misunderstanding of the purpose of the so-called "manual training" of forty years ago there still remains a feeling in the minds of some that there is a conflict between these two subjects. Strange as it may seem there are some industrial-arts teachers who still think they are supposed to teach a trade.

The original purpose of the subject was

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and is, general education. The trade angle crept in and was not definitely set apart until 1917 at which time the Smith-Hughes Act was passed, definitely defining the sphere of vocational-industrial education.

Those who clearly understand the philosophy of the industrial arts and trade education realize that there is no conflict between the two subjects.

We must remember that the industrial arts is a feeder to the trade courses, for, is it not true that many boys and girls have never had a thought of a trade training until after their discovery of special abilities in some line through their experiences in the industrial arts.

Truly the industrial arts and trade training are brothers and must cooperate as such.

We should not, however, make the mistake in believing that there are no vocational values, or that the outcome of the experiences in the industrial arts may not be vocational for some, since many do receive such benefits. It is merely a question of emphasis and we must realize, even though the vocational benefits are not stressed or supposed to enter the picture very strongly, we can neither dispute the fact nor prevent the pupils in their aim or desire to take courses with that idea in mind.

We must remember that there are great fields in industry which need the services of people who are acquainted with materials and tools and who have a sufficient understanding of industrial processes so that they function intelligently in jobs other than those of trained craftsmen.

We must remember also that due to new inventions in science and technological changes whole industries change. Some are wiped out over night and new ones take their place. This has happened again and again. An electric clock is invented and new types of workmen enter the factory. Radio comes in and the phonograph goes out. Silk is no longer available and synthetic processes go into effect. The priorities force certain industries to close and thousands are idle and looking for new types of jobs.

All of this means that general mechanical and industrial information is necessary for great numbers so that they may be able to make rapid readjustments time and time again. Yes, trade training is necessary for some but not for the great masses who will find their life's work in industry. Their needs are general industrial knowledge. The industrial arts is their source of this experience and it is evident, therefore, the work must be well done and pupils should be required to do their best.

Industrial Arts Has Made Great Progress

It is a far cry from the early days of the so-called manual training dedicated to exercise work when the school shop was in the basement. Today the picture has changed and we find the shop upstairs, in front, and in charge of a well-trained and professional teacher. *No longer* is industrial arts considered a special subject but a very important part of the general education program.

This is an industrial age and it is recognized by all educators that a knowledge of industry is a requisite of a well-rounded education. All girls and boys come in contact with tools and machines whether they are in the home, office, or shop. A knowledge of the safe and intelligent use of such equipment is a definite need of everyone. Since there is no other area in general education where such experiences can be gained, the industrial arts has been recognized as the logical agent to give this training. It is accepted as good education for, after all, is not a knowledge of one's environment considered good general education? John Dewey in his book, *Democracy and Education* writes:[1]

Study of mental life has made evident the fundamental worth of natural tendencies to explore, to manipulate tools and materials, to construct, to give expression to joyous emotions, etc. When exercises which are prompted by these instincts are a part of the regular school program, the whole pupil is engaged, the artificial gap between life *in* school and *out* is reduced. Motives are afforded for attention to a large variety of materials and processes distinctly educational in effect, and cooperative associations which give information a social setting are provided. In short, the ground for assigning to play and active work a definite place in the curriculum are intellectual and social, not matters of temporary expediency and momentary agreeableness. Without something of the kind, it is not possible to secure the normal estate of effective learning; namely, that knowledge getting be an outgrowth of activities having their own end, instead of a school task.

There can be no question that the industrial arts meets all the tests in regard to requirements of a general education subject. Too much time and effort has been wasted in trying to square our work with the "Seven Cardinal Principles" of Education." There has been a great deal of lip service and wishful thinking and not enough confidence in the real worth of our subject.

The industrial arts stands on its own feet and leads the way in developing pupil experiences agreeable to their age, capabilities, and needs for present-day life.

It would be interesting, if we could look into the minds of the instructors in the field, and study their answers to the question, why *they teach the specific subject they do,* and what their idea is of having more than one industrial-arts subject since it seems as if nearly all of the industrial-arts subjects meet all the recognized objectives of general education, such as worthy home membership, worthy use of leisure time, health, consumers values, handyman, tryout, etc., why then do we not settle on one subject such as woodwork? No doubt you know the answer but a few thoughts along this line may clear up your thinking in regard to this question of a variety of offerings and many types of shops.

[1]Dewey, John, *Democracy and Education*, The Macmillan Co., pp. 228–229.

Present-Day Trends

There has been a decided trend away from the old-time unit type and toward the general shop, so that we now have listed a great number of types of general shops.

We have noted the general agreement of leading educators that the industrial arts is a regular part of the general education curriculum which deals with the materials of industry and their fabrication for the use of man. It is evident, therefore, that it would be advisable for pupils to get as wide a view of industry as possible and this means of course, contacts with, and information of, a great variety of materials and processes.

In the early days of the unit shop with the handling and the processing of just one material, there was a very definite area giving rather complete knowledge and experience to the pupils in its use.

The idea of adding a multiplicity of materials was responsible for the development of the general shop and we found also such ideas as home mechanics, etc., being stressed. The latter grew out of the desire to meet the handyman objective.

This idea also has changed and we have the general shop which is getting away from the home mechanics idea and attempts to carry on several kinds of activities in one shop.

This type of industrial-arts shop has been very successful in the small community as it simplifies the problem of giving experiences in the use of a variety of materials without too great an outlay of money and where a number of unit shops would be out of the question.

We are experiencing another change in the general shop, in fact, it looks like a drifting back toward the one material shop such as general woodworking, general metal shop, and general electricity.

Where large unit shops have been successful, we find them broadening their activities in these shops. There are some who believe that the unit shop is out, but the writer is not of that opinion. In his opinion, it is a question of increasing the activity and introducing new materials in that particular field. A good example of this is the new machine shop.

In the old type machine shops very few processes and few materials were the rule. Today there may be dozens of kinds of alloys as well as plastics used in these modernized shops. The processes have been

increased a dozen fold as for instance: the many kinds of heat treatments needed to work these innumerable materials. Similar examples could be recited in regard to all types of unit shops which now have made many innovations which put them in the class of a general shop.

What the Future May Hold

We have been discussing the development purpose and field of the industrial-arts courses and, perhaps, it might be timely to look ahead and see what the future holds for the subject.

There is little doubt that there will be many new materials and new subjects introduced into school shopwork in the future and it is quite evident that the needs of national defense will cause us to drop others as well as open up new vistas for service. If the popular demand is heeded, however, I feel sure that there will be a very strong trend to include provision for teaching more about consumers goods, also the social effects of industry in its relation to community life. There are other trends which are affecting the work offered. There is a trend toward higher qualifications for teachers in the industrial arts.

If we are to teach the social and economic relationship of industry and the community then teachers must have a broader background of life experience. Evidently more practical experience will be required of teachers. Perhaps this will mean the transfer of some additional areas of education over to the industrial-arts field. Naturally, placing the responsibility of such work on them will mean industrial-arts instructors must have a high professional training in education to meet these new responsibilities. The study of many phases of sociology, psychology, and the other professional educational subjects will be mandatory and the utilization of the knowledge these bring will increase the effectiveness of their teaching and perhaps determine the length of time many instructors are allowed to stay in the teaching field agreeable with their willingness to assume these new responsibilities.

There are new fields to plow in the humanitarian phase of life and some cities have been fortunate enough to have had some experience along this line. Our department has been working with the physically and mentally handicapped. Included in this list are cripples (mainly from infantile paralysis), the deaf, the blind, some bedridden, and the mentally deprived. It has been a great satisfaction to find we could give these young people a new lease on life after they find they have ability to create beautiful things like normal children. Of course, there are other than "morale" values such as the vocational. An example of this which I would like to quote is that of a bedridden boy whom we were able to teach how to do beautiful wood carving and make jewelry, even though he must remain on his back all of his life.

It has been a great inspiration to us to know he has a shop of his own where he now helps earn his living by selling these products of his skill in handicraft.

This review would not be complete without mentioning the trend of extending the pupils' experiences out of the shop.

There is a growing tendency for home shops or hobby shops and it is our great good fortune that the industrial arts can aid in this work. Many men are spending a considerable time after school hours and on Saturdays in helping promote this movement. The opportunity to organize clubs and sponsor various recreational and craftsmanship contests has been accepted by many and the influence of the industrial arts grows and grows.

This is a grand work and should not be neglected since it gives us an opportunity to reach a great class of people who need our help. We know that industry is lowering the age at which they will continue to employ men and also they have raised the age for entry into industry. This means that there are many young men who will have a period before going to work in which they must have some interest to keep them from losing heart or becoming demoralized. The draft has helped this cause but will find it more than necessary to find a means of building up the morale of those who are rejected.

The condition of the older people is helped by bringing the handicraft into the home, *for* many of these older people have never learned the art of self-entertainment and their participation in the home shop and its handicraft is a substitute and often the beginning of a new opportunity to commercialize new-found talents.

In forecasting trends in education it seems as if there are growing responsibilities which teachers must accept regardless of what they are teaching. If we are right in our contention that education is the development of the physical, moral, and intellectual abilities of the individual then we have some responsibilities for which common complaint leads one to believe we have not done our best. We daily hear complaints that our people especially many young people are irresponsible and demoralized. That this is true is evidenced by the increase in crime between the ages of 16 and 23 years of age.

We are also reminded of the pitiful condition of those who are too old to get back into gainful occupations and are cracking under the strain.

It is not necessary to review the reasons for all of these conditions but it would seem expedient to study the question and determine what our future responsibility to this question is.

We in the field of industrial education can and should do a great deal about this. After all this is a question of character building and nowhere in education is there a greater opportunity for making a contribution than in our own field.

A lack of responsibility and stamina can be traced directly to a lack of confidence in one's ability to hold his place in the rest of society. The antidote to this, it would seem, is to develop the abilities necessary to accomplish things equal to that of others; to teach the individual he has capacities which are necessary to the success of any individual. An example is, the art of planning and problem solving which is an inseparable part of our work and taught in all well-organized industrial courses.

The initiation and successful completion of a project in the shop is a tangible evidence of this ability. The quality of the work depends after all on the honesty and diligence of the individual. He learns that good results depend on honest effort and the value of the project depends on honest work.

He recognizes that the project is the result of his hand and brain and he knows *whether* he has shirked *or not*, and there is nothing he or anyone else can do to change that fact. He knows *now* that *careful, thoughtful* work pays. He knows that there is nothing he can do or say which will alter this fact and another lesson in character forming has sunk into his consciousness.

This subject could be enlarged to show that we *can* and *do* teach the value of getting along with our fellow workers, the just evaluation of another's *as well* as our own efforts, etc.

These thoughts have not sufficiently taken into consideration one of the most valuable psychological effects which is generally accepted as a stabilizer and antidote for demoralization, that is, giving the individual something which acts as an anchor, in other words something he can tie to such as trained salable abilities which assure the individual he is not one apart but one of many necessary links in the scheme of things.

Teachers must accept greater responsibilities and think more of the influence of their subject on the individuals than just the skills and subject matter. This is particularly true today, since specialization in industry is taking away much of the joy and pride of craftsmanship and replacing it by more and more routine machine operations.

The industrial arts is a part of any well-organized system of education. It is not only a necessary part of general education but a great motivating force which is growing in importance day by day and anyone should be proud to have a chance to work in this field. It is a work which has no limit for the teacher who has ambition and the desire to serve in the great cause of education.

Problems in Related Instruction

BENJAMIN J. NOVAK*

In contrast with the earlier, more difficult days, vocational schools, "trade," "industrial," and vocational education, are rapidly reaching a firm, permanent footing. Recognition, although still somewhat grudgingly given, is being earned. The sudden demands for industrially trained men and women occasioned by the great war, have placed upon vocational schools and departments heavy responsibilities and burdens. The generally successful handling of war-production training programs has won for the cause of vocational education further praise. The unique feature of vocational education, the school shop, has made remarkable educational contributions and has been admired and respected by educators and laymen alike.

Unfortunately, it appears that the half of the program which is generally termed the *related subjects* has not managed to keep pace, and has become by far the weaker portion of the unit. It is to be regretted that many vocational educators have fallen into the habit of mentally shrugging their shoulders and speaking apologetically of the situation without taking steps to provide a remedy. There is an inexcusable neglect of the entire field of related instruction. The few textbooks in the vocational education field treat the topic very hastily and superficially, if indeed at all. There is nothing in the periodic literature. Vocational education conventions and meetings seldom devote any time or attention to this important problem.

The causes for the condition are numerous and worth considering. There has been considerable confusion as to the aim of related instruction, resulting in a lack of confidence on the part of students and teachers alike in its value. Unique administrative difficulties have generally necessitated disheartening roster complications. Serious-minded related subjects teachers have been in doubt as to what should be taught and the methods to be used for presenting instructional material.

Without presuming to prescribe remedies for the confusion, it was thought helpful to analyze in some detail the problems in related instruction, and present a few of the practices followed by various vocational schools and educators.

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Aims of Related Instruction

The purpose of related instruction is generally stated to be to meet the vocational needs and interests of the students, as well as to develop a *well-rounded* individual. For mechanical trades, science, mathematics, and drawing are generally considered to be *technical*, while such subjects as English, social studies, music, and the like, are termed *cultural*. It is apparent, however, that the division between the groups of subjects is artificial and perhaps undesirable. Some of the mathematics and science may not apply strictly to the trade, and the social-studies department, for example, should give considerable attention to labor relations, unions, parliamentary procedure, industrial history, and the like. In certain localities and under certain conditions, the term *related* is applied to mathematics, science, drawing, and sometimes social studies, but not to English. Some individuals are impatient with the name *related*, and would abolish the designation entirely.

The two vague general aims have been expanded into more specific objectives by a number of educators. The list which follows is derived in the main from Magill[1] and U. S. Vocational Education Bulletin No. 1.[2]

1. To provide the necessary *tools* for working in the trade. For example, certain phases of mathematics, English, and mechanical drawing are indispensable for shop computations, *layout* work, etc.

2. To give a basis for understanding the trade operations and processes, in order that they may be performed safely, intelligently, and efficiently.

3. To provide a background and understanding of industries related to the specific vocation being studied. The purpose is to enable the student to be a more intelligent worker by showing the place of his skill in the complete industrial process. It furthermore should be of aid in keeping pace with changing conditions, and in facilitating a transfer to a related skill in the event of technological unemployment.

4. To develop an understanding of the working world, and the place of the worker in society. To understand industrial organization and industrial relations.

5. To provide for intelligent consumer education, leisure activities, and self-directing citizenship.

6. To prepare capable individuals for industrial leadership and foremanship.

As is common with objectives as broad in scope as those presented, almost any instructional material can by rationalization be said to fall under one or more of them. These objectives should be useful, however, as a guide to thinking.

Problems in Administration

The minimum age for entrance into vocational education is set at 14 years by the Smith-Hughes Act. In various localities other requirements are superimposed. Some institutions require completion of the ninth, tenth, or even the eleventh grade. Prior to the war at least, many schools preferred students to enter at 15 or 16 years of age or even older. The thought was to ensure greater physical maturity, seriousness of vocational aim, and to have students of acceptable age for employment at graduation. Because vocational schools and courses are relatively limited and in great demand, students come with varying backgrounds, experience, and age. The unusual heterogeneity of the vocational school population entails a significant teaching problem.

Many vocational schools have in recent years introduced or expanded systems of selection[3] of students. The reasons are several: (1) To eliminate the *subnormal* students incapable of profiting from the instruction. Many academicians have for a long time held the view that vocational schools are institutions for the backward, and have been mistakenly *guiding* those students there. (2) To provide an objective basis for admitting students where the number of applicants exceeds vocational school facilities. (3) To provide information useful in guiding students after admission.

The methods of selection vary considerably among vocational schools. In some cases the students are briefly interviewed. Some schools admit students on the recommendation of the school previously attended. In certain instances the previous school record is the deciding factor. Some schools prescribe meeting of physical requirements only. Other institutions consult intelligence test scores. In other cases paper and pencil tests of mechanical aptitude, mathematics achievement, or vocabulary are used. In a few instances students are required to submit evidence of hobby or other work, or are asked to manipulate tools in a shop. In most institutions various combinations of the above methods are employed.

Requirements for graduation vary considerably. In some cases it occurs automatically upon the completion of a specified number of hours in shops — or a specified number of months or years of attendance — or, irrespective of time, upon the attainment of a certain level of skill. These features all have a bearing upon the organization of related instruction. In many cases students are admitted from a high school after having completed a varying amount of high school work. Some give part or full credit for related subjects.

Since almost every program is made up of a greater or lesser variety of trades, the student population in any one trade is rela-

[1]Magill, Dr. Walter H., Professor of Industrial Education, University of Pennsylvania.

[2]Vocational Education Bulletin No. 1. "Statement of Policies for the Administration of Vocational Education," p. 34, United States Department of the Interior, Office of Education, 1937.

[3]"The Selection of Students," pp. 390-391. *The Phi Delta Kappan*, April, 1940. "How Effective is Selection of Students for Vocational Schools?" *Education*, pp. 533-537, May, 1941.

tively small. It becomes frequently impossible to roster full classes, especially in the upper grade levels. Some schools ignore trade differences and enroll students indiscriminately in related classes on the basis of grade level only. Another practice is to attempt to combine grade levels in trades that have some basic similarity — examples that might be cited are: combination of machine construction and drafting, patternmaking and cabinetmaking. Still another procedure is the enrolling of trade groups in all classes as a unit, irrespective of grade level.

The federal requirement of a week of 30 clock hours results in a longer than traditional school day. The fact also that the classroom subjects occupy only 50 per cent of the school time means that relatively less time can be allotted to each of them than is customary in high school. This is likely to require that the related teacher meet a large number of different classes, necessitating more preparations. Some institutions seek to improve the latter condition by reducing the emphasis on certain subjects or eliminating them entirely; another procedure is the alteration of related subjects by terms.

In large vocational schools it is probably a common practice to have related teachers who are subject specialists, as in the regular high schools. The enrolling practice is to assign instructors to the teaching of one or a few of the related subjects.

In a small number of cases, a related teacher specialization by trade has been practiced. In this arrangement one individual instructs a trade group in all the related subjects. Still another practice is the teaching of technical subjects like mathematics, science, and drawing by shop teachers, while the classroom teachers instruct in the remaining subjects like English, social studies, and physical education. The last two mentioned practices are said generally to be resorted to in small vocational programs in which there are not enough students or teachers to permit class specialization by subject. Some individuals consider that these plans may have value even in larger institutions.

A few schools, especially those featuring food trades, have a full week of shopwork alternating with a week of related instruction. The claim for this arrangement is that a full day of shopwork permits the completion of projects which could not otherwise be attempted if interrupted by related work. Some individuals have the opinion that the weekly intervals between the shop and related classes are undesirably long. Probably most vocational schools have the day divided, with half devoted to shopwork and half to related subjects. Shopwork may be given every morning or every afternoon. In some cases, rosters have been constructed so that shop is given in the morning several days of the week and in the afternoon on the remaining days.

What Should Be Taught?

The problem of what should be taught is by no means one which is confined to vocational education. Of the almost incomprehensibly vast store of skills, knowledges, beliefs, and behavior patterns, only the most essential can be selected for attention. There is endless controversy among educators, students, and enlightened thinking people in general, over what should be included in order to best meet the needs of the learner.

Some individuals claim that, since vocational school students are basically the same as high school students of the same age, the classroom subjects should be practically identical with those offered in the high school. At the other extreme are individuals who maintain that all related instruction should be completely based upon, and directly applied to, the trade. Most vocational schools in practice tend to attempt a course somewhere between the extremes. The results thus far appear to be decidedly indifferent. Genuine difficulties in organization such as have been pointed out have caused considerable discouragement and frequent relapse into textbook teaching of academic material. In order to comply with the requirements contingent upon securing federal subsidy, vocational schools avoid using academic terms like physics, chemistry, algebra, trigonometry. It is required that the work be called merely related science, related mathematics, etc. Whatever may be the advantage of such a terminology, the fact remains that employers and, more recently, representatives of the armed service insist upon an evaluation of credits in algebra, geometry, and physics. The general public has been conditioned to think of classroom subjects in their academic terms.

It might be desirable to review some of the possible approaches in determining what should be the curricular content:

1. *Job Analysis:* This is the best-known approach, and the one most frequently mentioned. The various occupations are broken down into operations, and the attempt is made to determine what related instructional material is needed to perform the operations. The United States Office of Education has published monographs of analyses of various trades, and there have been a number of similar analyses made at various graduate schools of education in the form of theses and dissertations.

Such studies are often limited and inadequate, despite their undoubted value.

2. *Opinions of Experts in Field:* Another approach is to ask acknowledged experts for their opinions as to what instructional material is most fundamental. It is generally the policy to submit an outline made up of items which may be checked off by the *expert* as essential or nonessential.[4] This approach has the limitation that so-called experts are likely to devote too little time and thought to questionnaires. Furthermore, there is the tendency to check as important anything looking familiar, irrespective of its possible significance in a trade.

It seems unnecessary to discuss in detail the other methods which are to be found in standard books on curriculum. Some of the methods include: analysis of adult activities, analysis of literature, analysis of adolescent needs and activities, and so on.

It will be probably agreed that no amount of statistical analysis and objective research can displace teacher judgment. No matter how valuable any body of material may be to the adult or the trade, it must be adapted to the adolescent learner. The teacher must motivate and direct the learning, and in so doing he may be required to add or delete instructional material, depending upon the needs and capacities of the particular students with whom he happens to be dealing.

One purpose, it will be remembered, is the providing of a background which will make the student a worker of some adaptability. Young people frequently compare questioningly the length of regular day school curriculums with the short period of training often without related instruction of many of the war-production training courses. Aside from the compulsory attendance laws, minimum employment-age standards operating in peacetime, and developmental needs of adolescents, there is the object to make these students capable of understanding and controlling industrial processes. The aim of the War Production Training Program is generally to develop, as quickly as possible, a skill in a single operation. These short-term trainees are not expected to become mechanics in the real sense of the term. It should be realized, of course, that a vocational school graduate is not usually a fully qualified mechanic, but it is hoped that he has the foundation for becoming one upon the acquisition of working experience.

How Should Related Material Be Organized and Presented?

Some advocate a psychological organization of material in which a shop problem is used as a basis, and related instruction is given as it is directly needed to solve the shop situation. As an example, in a mechanical trade, such a topic might be *gasoline*. Instructional material covering an extended period might be developed from it. Some individuals claim further that the related material should be taught simultaneously with the need for it in the shop.

Many take the view that there is greater economy in learning, as well as a better background for the student, resulting from a logical instruction in fundamental principles, motivating and vitalizing the teaching with trade applications.

Still others advocate a year or more devoted to *basic principles*, with projects having specified trade application being reserved for the latter parts of the course.

It should be remembered that many students come to vocational schools from academic institutions because of a dislike for the abstract and *impractical* classroom subjects.

[4]Studies of this nature are being conducted in the course "Curriculum Construction in the Related Subjects" at the University of Pennsylvania as part of the Vocational Teacher Training Program. This is under the Direction of Professor Walter H. Magill.* An individual member of the class draws up a list of principles from one related subject matter field and submits it to workmen, foremen, and shop teachers in a given trade. These *experts* indicate whether a given principle is essential, desirable but not essential, or unessential.

*Director of Industrial Arts, Cleveland, Ohio.

The related subjects' teachers must, in addition to their heavy and confused roster and curriculum burden, exert exceptional efforts toward motivation. The modern vocational school student, whatever the soundness of the question and his qualification to ask it, demands to know "what good is this going to do me in my trade?" The effect is to stimulate the thinking of the teacher to find a reasonable justification for the material he is giving. Whatever *disciplines* are to be derived from related instruction, must be realized to a considerable degree from instructional material which is at the same time inherently useful.

It seems desirable that the related teachers be assigned to a limited variety of trades for teaching. If alert, he can learn enough of the general materials, procedures, and terminology of the trade to make intelligent applications of related subject material. It is highly important that related teachers keep in touch with working conditions by working during summers, at least in alternate years. In this way it is possible to learn the technical, social, and ethical needs of workers. Generally students experience greater confidence and motivation from a related teacher who is not entirely academic. Some related teachers, particularly of mathematics and science, prefer a specialized study and devotion to a single trade. One wonders whether the too specialized related subjects teacher is in the best position to instruct the adolescent whose needs for general living, and even trade background, are more fundamental than specialized. The tendency is common for a person who specializes too narrowly either to become stagnant or to develop material of too technical a nature. It should be remembered, furthermore, that public federally authorized vocational education is specifically required to be of "less than college grade."

In presenting instructional material in the related subjects, many people have advocated and attempted to practice individualized instruction, based upon units or *contracts*. The heterogeneity of student background, trade, combinations, and textbook limitations, have served as the stimulus. Since most shop learning is accomplished admirably in individual *jobs*, the argument is advanced that the same procedure should prove successful in the classroom. In actual practice, the exclusive or excessive use of written units in the classroom is likely to dull interest and militate against effective learning. It may be stated further that mechanically minded students are not generally fluent or persistent readers.

It is a fact that less extensive use can usually be made of available textbooks than in high school. The alert teacher is of necessity obliged to organize in mimeographed form significant portions of instructional material in order to insure efficiency and definiteness in teaching. Learning is likely to be stimulated by the use of active student participation, demonstrations, teacher presentations, and similar concrete approaches.

Related instruction can probably be conducted best by the alert teacher who applies any or all of the recognized instructional methods, depending upon the needs of the group being taught. The average groups who are embarking upon their vocational school careers are taught most effectively, probably, with group methods of instruction predominating. As the students mature and develop the habit of individual work on *jobs* in the shop, individual activities may then be expanded and used.

Instructional and test material should be flexibly organized. Students of advanced maturity and background can by means of achievement tests be placed in related classes which will be stimulating and valuable to them. This will prevent deadening repetition, waste of time, and discontent.

Recommendations

In the light of the present situation in the field of related instruction it seems helpful to offer the following suggestions:

1. One general and definite need which merits immediate attention is that for more writing in the vocational-education field. Probably more professional reading on the part of vocational teachers is needed. This is reflected in the fact that there is at present but one vocational-education journal of any importance; several others have been discontinued, apparently because of lack of support.

It seems to be almost a tradition among vocational educators that they work quietly and industriously at their tasks, without taking the time to acquaint in writing their fellow educators with what they are doing.

The public can hardly be charged with responsibility for their ignorance of the existence and work of vocational education when they seldom hear or read anything about it. At the present time there seems to be little interchange of ideas, excepting by word of mouth at meetings or conventions. Almost invariably each local vocational education program is undertaken without being able to draw, to any appreciable extent, upon the experience of established institutions elsewhere.

In the field of related instruction there is great timidity and reluctance to exchange ideas. The excuse frequently given is that the field is "too new to have anything to show yet." It is a fact that practically all of our vocational-educational systems have been operating for only a relatively brief period. Even in these few years, however, some materials and ideas have been developed, however imperfectly, which are worth sharing and developing. Uncertainty and evasiveness are clearly shown in the vague reports many people give: "the related work consists of the essentials that directly apply to the trade."

It should be clearly understood that there is not being recommended, either directly or implicitly, the centralization or standardization of vocational education beyond the legal requirements. It will be agreed, however, that the making available of information and ideas permits a more rapid and effective development of the individual programs. The duplication of effort appears at present to be unnecessarily excessive.

2. The increase in professional vocational education in colleges and universities offers an opportunity for research in the related subjects field, as well as other phases of vocational education. Curriculum studies can be made and content developed under the guidance of competent professors. Useful and acceptable survey studies of practices in vocational education might well be made in the form of graduate theses.

3. In many situations, related teachers seem to carry an excessive load. It would be desirable to conduct studies of teacher load, applying these formulas now in general use by educators. If this impression is verified, obviously the teacher load should be reduced.

4. Time, and possibly funds, should be devoted more extensively than at present for the study and development of curriculum content by competent teachers and curriculum specialists.

5. The need for textbooks still is great in the related subjects. Very recently textbooks have been appearing in ever increasing numbers. Many have been unusually valuable and useful. An appreciable proportion, however, appear to have been written in haste and with poor planning, consequently having limited value.

6. A more closely knit association of vocational schools, permitting a more easy exchange of ideas and materials, is necessary. The wide geographic distribution of centers for vocational education makes this task unusually difficult, but not impossible.

7. The growing maturity of the vocational education movement should make possible the training of properly qualified individuals who are planning to become teachers of related subjects. In contrast to the present teachers who generally have been recruited from other fields and given a few professional courses in vocational education, the newer instructors should be given the benefit of a more complete and better balanced training program. It is perhaps unnecessary to note that an adequate salary schedule is an influential factor in attracting able individuals to the field.

THE SUCCESS

I never paid attention
  All the time I was in school,
And as for doing homework,
  Do you take me for a fool?

My study time I used for naps,
  Or comic books I hadn't read,
And I copied all the answers
  From the fellow up ahead.

No Siree, I never listened,
  And look at me, I'm doing swell,
I'm the first assistant porter
  In a fifty-cent hotel.

— *Leonard E. Schmidt*
Lincoln Hall Vocational Shops,
Lincolndale, N. Y.

INDUSTRIAL ARTS AND VOCATIONAL EDUCATION

John J. Metz, Editor

The Coming Vacation Days

"WHAT am I going to do this year during my vacation?" This question may well be considered by all teachers, especially those who are now teaching industrial arts and vocational education.

To the one, a course at summer school may offer the best solution to this problem. The teacher who has some unfinished work separating him from a coveted scholastic degree should take advantage of every opportunity to attain his educational goal. This year, especially, offers a fine chance to spend considerable time at some university, acquiring knowledge, which will enable one to do the job of teaching a little better and a little more effectively.

When planning for this summer session at school it may be well to consider that it can and should serve the dual purpose of furnishing both mental and physical growth. For this reason, the summer school program should contain a goodly portion of the courses which are needed to make the instructor more conversant with the material which he teaches in the classroom, but gymnasium and athletic work also should be included. This is so often overlooked by teachers who have been teaching for a number of years. It is true, many such summer school students will play golf, go swimming, boating, and hiking, and in that way get some wholesome, bodily exercise. It may be better, however, if these men would enroll also in gym classes, and thus get accustomed once more to follow a directed course which under present conditions will most likely be patterned after the typical army muscle building exercises. This regimentation may not be to everyone's liking, but it does precondition the individual to what is coming when he enters the army, no matter at what level.

Then, too, such a course may be just what is wanted as a preparation for giving students the physical training courses prescribed for the preinduction work to be given in high school. The gym work at the summer school may give teachers a vivid idea of what a commando course asks of the pupil, how an obstacle course may be laid out, and how the various obstacles may be built.

Other teachers, instead of attending summer school, may want to avail themselves of the opportunities offered by industry to aid in the war-production program. Mr. Earl L. Bedell, in his article entitled "Summer Employment for Industrial-Education Teachers in Essential War Industries," which appears on page 185 in this issue, shows the opportunities, possibilities, and advantages which this type of vacation program offers to the shop teacher.

Spending vacation time by aiding the war-production effort may also be very educational, especially for those shop teachers who have had little or no practical experience in the type of shopwork which they have been asked to teach at school. A month or two in an industrial shop may be a very strenuous way of spending a vacation as compared to one spent in resting at a lakeside cottage, but it will be a very worth-while and instructive experience. Besides providing experience, such a vacation will satisfy the patriotic urge which every good American feels during these days when our country is in peril.

Preinduction Training

AT THE Saturday morning industrial-arts session of the Illinois Vocational Association convention at Peoria, Ill., Lt. Col. Verne C. Fryklund gave an enlightening and authoritative statement on the need of preinduction training in high school.

Practically his very first statement brought out the fact that the new 18-year-old inductees are not as ready to take the army induction training as were the older men who have been inducted up to now. Evidently the fact that the older inductees had more experience helped them to get more out of the three months' training which the army gives those who enter its ranks.

It also must be remembered that 87 per cent of an armored division consists of specialists, who must have knowledge, speed, accuracy, and confidence in performing their particular duties. Furthermore, it must not be overlooked that there is no reason to believe that this war will be over in a short while; hence, it will be our 18 year olds who are the ones who will win this war.

The 18 year olds are no longer in high school. They are in the army and school can no longer prepare them except as the army sees need for school training. The 16 year olds, however, will be with us for another two years. They can and must be better prepared than their brothers who are now being inducted.

What can the school offer these boys who in two short years are to assume the responsibility of fighting this country's battles? What help can be given them to better fit them into the six hundred odd jobs in which the army needs men with specialized training?

Many of these jobs are quite technical. Many of them require a sound knowledge of science and mathematics. These two subjects, therefore, must be emphasized in high school, but they must be adapted to the needs. The training must be simple and thorough. The physics must be applied to the electrical gadgets, to the automotive equipment, and to the mechanisms of guns and other army equipment with which the soldier is equipped to go into battle.

The emphasis must be placed on the ability of using the knowledge practically. Long abstract discussions are out of place. The end result must be a quick understanding, and the acquiring of the ability to apply effectively that which has been learned.

This preinduction training cannot be merely an academic assignment. The need is for young men who possess certain basic skills. Their knowledge of machines, tools, electricity, and auto mechanics must be about what industrial arts has been attempting to give in the school shop. The work, as given in the past, however, must be intensified. The objectives of industrial arts must be re-evaluated for the time being, and must be given an almost vocational direction.

Our skilled men are getting fewer, and the boys in the industrial-arts classes must be prepared to take their places. Preinduction training is, therefore, a very definite industrial-arts obligation.

But there is more to be done for our 16 year olds. Besides the required knowledges and skills they must acquire the right attitudes. As was quite evident from the addresses given at Peoria by both Brig. Gen. Stephen G. Henry and Lt. Col. Fryklund, many of the inductees have no clear understanding what this war is all about, or why they should be concerned with the outcome of it.

The 16 year olds must be made to see what a priceless boon it is to be an inhabitant of these United States. They must be shown that our soldiers are fighting very definitely to maintain our home life. They must be shown what caused World War II, and why we had to engage in it. They must know how their individual efforts can assist in winning this war. They must be given a good understanding of first-aid practice so that they can recognize shock, sprain, simple and compound fractures, and know what to do, and especially what not to do, in each of these cases.

They should also know something about the organization of the army and what is expected of the man who is about to be inducted. They must be coached so that they can quickly adjust themselves to army life, and they must be helped to overcome their fears of the unknown.

Preinduction training is a big undertaking, and all teachers must assist in doing their part plus a little more if the job is to be done right. It is well to remember that the best way to help our soldiers to return home safe and sound, is to give them the best possible training so that they know thoroughly, just what to do under all circumstances in this gigantic effort to save all humanity from slavery.

Vacation Days and the Student

NO DOUBT many of the older high school boys and girls will spend most of their vacation days helping the war effort by working on farms, taking care of children of mothers working in war industries, or taking entire care of a household while the other members of the family are working at furthering the country's victory-production program.

There are, however, a great many younger children who, because of present conditions, will receive less supervision and thoughtlessly may run grave danger of being injured or of losing their lives. These youngsters need preconditioning for their vacation days, and this may well be done at school, especially by shop teachers who know how to teach specific as well as general safety.

Probably the most important point to emphasize is the need for strictly observing all safety rules in crossing streets and highways. It is true, gasoline rationing will cut down automobile travel, yet it takes but one auto to do a lot of damage. Children who thoughtlessly dash out into the street or highway may be struck by even slow-moving vehicles. Calling their attention to these dangers now may save lives later on.

The need for this type of safety work is clearly shown by the following quotation taken from a safety bulletin published by the Milwaukee Safety Commission:

"Despite a greatly improved traffic safety record in Wisconsin, the man-power loss resulting from accidents is serious, as noted by the State Motor Vehicle Department.

"A study reveals that of October's 44 traffic accident victims, *four* were *farmers* and *four* were *farmers' helpers*. Others killed included *two army lieutenants, five truck drivers, five housewives,* a *shipyard worker,* a *concrete worker,* a *paper-mill worker,* a *metalworker,* an *ordnance employee,* a *painter,* a *laborer,* and *five school children.*

"These persons will be missed on farms, in homes, in schools, in war plants, and in the armed forces."

Then there are the dangers accompanying the many water sports in which children as well as grownups like to indulge, such as canoeing, boating, fishing, and swimming. These are all accompanied by their own type of dangers, all of which should be vividly and dramatically emphasized to the students now, if they are to act as effective deterrents during the summer months, when the ebullient spirit of youth prompts rash undertakings.

Another point that has to be strongly emphasized is the safe handling of matches and fires, at home as well as in fields and forests. Carelessness in this regard costs the country millions of dollars every year, besides causing injuries, suffering, deaths, and much mental anguish to those who may be entrapped, without any fault of their own, in the path of a conflagration that has been caused by the carelessness of another.

Even such seemingly innocent games as flying kites may result in serious dangers to the child who does not recognize the hazards as they arise. High-voltage electricity may easily travel along a kite string that is entangled among the transmission wires, especially when that string is slightly damp. Young children do not know this. Their attention must be called to such dangers. Then, too, many a boy was seriously injured and permanently crippled because he ventured too far out on a weak tree limb to loosen his favorite kite. The youngster may not recognize the danger to which he is exposing himself until it is too late. A little safety talk telling him about these unknown dangers may spare him suffering.

Many other danger factors may be added, but the thing to remember is that there is still time to take care of this type of safety instruction. Let's make the best use of that time.

"We'll Have to Take Better Care of the Things We Do Have!"

A Method of Teaching Auto Mechanics

H. C. SEYMOUR* and CHARLES SANDS**

The increase in use of automobiles[1] has brought with it a demand for expert auto mechanics upon whom is placed the responsibility of maintaining cars at a standard essential to effective operation and safety. The need for trained mechanics is being increasingly felt and for this reason those in the field of vocational education are searching continually for better methods of training young men for this trade. It is the purpose of this article to describe one method of teaching auto mechanics which has been developed in an Indian boarding school.

Boarding Schools for Indians

The United States government has established schools for Indian youth throughout the country. Some of these institutions are located on Indian reservations; others are located in cities and towns. One of the latter type is located at Albuquerque, N. Mex., where Pueblos, Navajos, Apaches, Utes, and representatives of other tribes enroll as secondary school pupils. The school enrolls Indian pupils from grades 7 to 12 and accepts postgraduates for as long a time as the individual student can be given training from which he can profit. The school is called a boarding school since all pupils arrive in the fall and remain until the following spring. The government furnishes dormitories and a dining hall, as well as a shop and classroom space. Each school, therefore, becomes a miniature community where services are performed similar to those available in small towns and villages. Thus the program at Albuquerque includes a tailor shop, a shoeshop, a store, a kitchen, a bakery, woodworking and carpentry shops, a farm and dairy, shops for masons, electricians, painters, auto mechanics, machinists, and blacksmiths.

Each enrollee at the beginning of the seventh grade chooses a shop where he will remain for the entire 18 weeks of the first semester. During the second semester a different shop is chosen as is done each successive semester thereafter during his three junior high school years.[2]

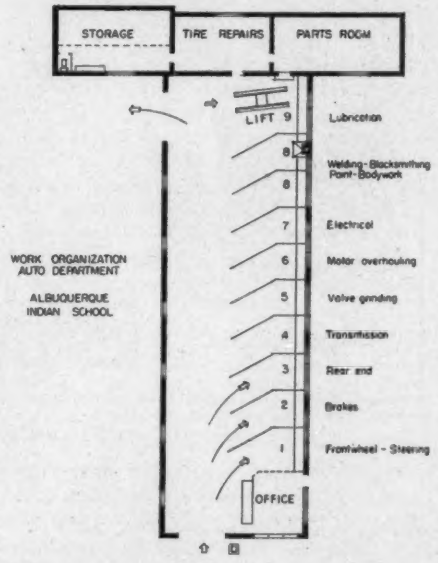

Fig. 1

The Course in Auto Mechanics

Beginning with the tenth grade, each student has the opportunity of specializing in one vocation in which he is interested. Although it is not compulsory that each student elect one of the vocations which he has experienced on a tryout basis, it is nevertheless true that most pupils begin to specialize on the basis of their earlier tryout experiences.

The auto-mechanics course is popular. Emphasis these days upon mechanized transportation has resulted in heightened interest in auto-mechanics instruction. A number of students are interested though their qualifications often indicate a lack of ability. In order that the school might determine who are really fitted to become auto mechanics, the course at the tenth, eleventh, and twelfth-year levels is designated as general auto mechanics but is more often called a service course since the emphasis is not so much upon technical auto mechanics as upon the less complicated operations of maintaining and repairing a car. The ordinary repairs that the layman must perform are stressed.

Boys who elect to take auto mechanics at the beginning of the tenth grade spend one

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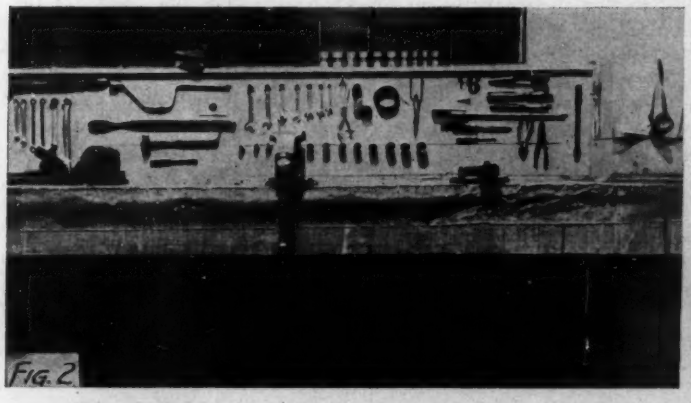
[1]This article was written before the rationing of automobiles became effective!

[2]The writers are somewhat skeptical of tryout experiences of only six weeks. The longer allowance of one semester somewhat limits the breadth of choice, but offsets this difficulty by actually giving boys a real opportunity to investigate a maximum of six trades.



This permanent workbench, extending from line 1 to line 9, is located at the east end of the shop in front of each car. See Figure 1. This illustration shows the section at line 6. Each tool has a particular location on the tool board. The form of the tool, painted onto this board, shows very quickly what tools are missing or mislaid. The boy, shown at the right, is in line 3. He is assembling the rear end of a standard make of car to gain practice and speed

Albuquerque Indian School - SHOP REPORT - Santa Fe Indian School

Name..... Grade..... Div..... Quarter 1 2 3 4 (Please Circle)

	JOB SKILL	TECHNICAL INFORMATION	HOURS	ATTITUDE P	ATTITUDE G	ATTITUDE VG	WORKMANSHIP P	WORKMANSHIP G	WORKMANSHIP VG
1.									
2.									
3.									
14.									
15.									

BAIRD ANDERSON PRINTING CO., ALBUQUERQUE, N. M.

Total..... Absent (No. Hours).....

School..... Instructor..... Shop..... Date.....

Fig. 5. The shop record card

half a day in the shop, the other half in the classroom where they receive academic training. The setup closely follows the program under which the Smith-Hughes law operates.

The first shop unit is learning to drive or, if the pupil already has his license, the improvement of driving technique. The safety instructor in the school gives each boy at least ten hours of driving instruction and rates each according to his ability to handle different kinds of automotive equipment. Greasing, oiling, washing, and car checking are other units offered in this first year. In the eleventh and twelfth years minor car repairs are added and by the time the boy completes the twelfth grade he has not only learned many repair operations, but through repetition has had opportunity to develop speed as well as accuracy.

This extensive exploratory period is valuable in helping the instructor to select the boys who later enroll as postgraduates in the auto-mechanics shop. By the time these pupils have graduated from the twelfth grade, the instructor knows those students who may profit from additional training in auto mechanics.[3] Those whom he rejects he tells frankly why he believes they are unsuited to become trained mechanics. He guides the best drivers into the Indian service as drivers. Others use the training to care for tribal or personal cars within their own village.[4]

[3]It has been argued here by critics of the system that this double-screening process — the tryout period during junior high school and the general auto-mechanics course during the tenth, eleventh, and twelfth grades unnecessarily prolongs the period of time of education for youth. It is said that such a program works a hardship for youth who need and wish to enter the occupation as early in their careers as possible. In the first place, an early choice has not proven to be always the best choice. Secondly, because of legislative restrictions industry has been unwilling to employ youth until they reach at least a minimum age of 18. The tendency is for postponement of employment of youth. Furthermore, for Indian Youth the essentials of auto-mechanics instruction is good general education. It would even be excellent consumer-education for white boys in city or rural high schools. The criticisms are not as serious nor as fundamental as the reader might judge upon casual examination of the system.

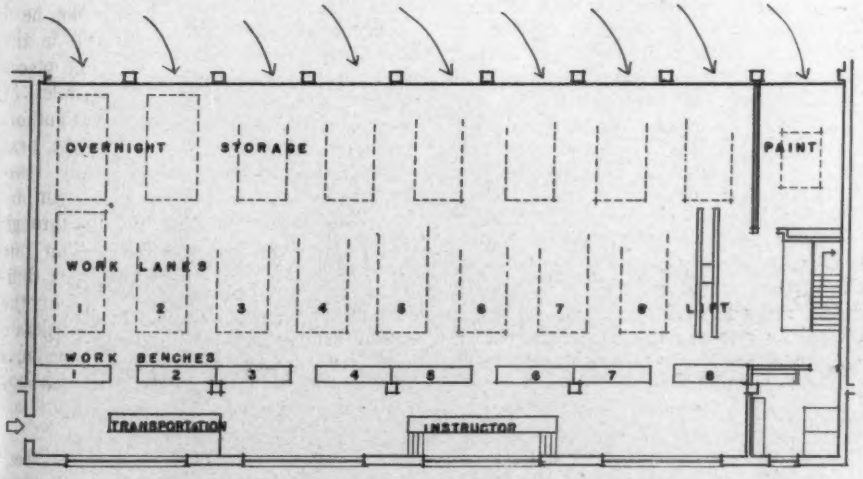


Fig. 6. The proposed auto-mechanic shop at the Santa Fe Indian School

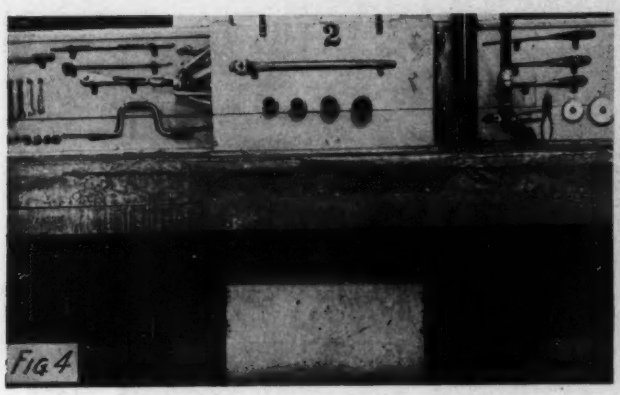
At the end of the twelfth grade the head auto mechanic selects those[5] who may profit from an intensive course, always with the thought of how many the Indian service and private industry can and will absorb. Those who are selected from the intensive course on a postgraduate level report at the auto shop at the beginning of the working day in the same manner as do auto mechanics or other tradesmen. There they spend the entire day except for two 45-minute periods when they leave to work for their room and board. Learning to remain at a job all day has its advantages. When the school day is broken into 45-minute classes, students come to expect change and variety which they continue to expect during their first months of employment.

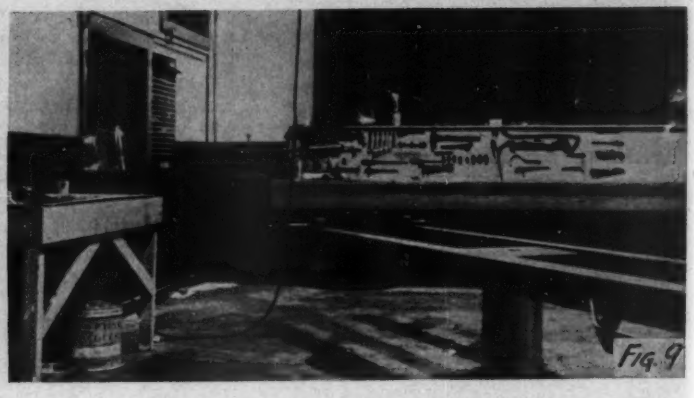
No definite time limit is set into which must be crowded all the essentials of auto-mechanics instruction. Students remain at the school until they are trained or placed. In general, boys take three years to complete the projects assigned, but some complete the work in a shorter period of time.

Before proceeding to describe a typical working day and the line system of instruction, it might be of interest to know the manner in which cars are made available for repair. The management of two boarding schools at Sante Fe and Albuquerque is under one superintendent. Within that organization there are 38 pieces of automotive equipment, 10 passenger cars, 8 large trucks, 6 pickup

[4]It has been said that this program is wasting the time of the boy who thinks he is interested in auto mechanics, but who in the end is not proficient enough to be selected for the special training offered on a postgraduate basis. Interestingly enough, those who are the least capable fall out along the route, some transfer to other courses, and a few are actually guided into other trades. The course is self-exploratory and self-factfinding. By the time the group reaches the twelfth grade, they are already well selected.

[5]Boys from other Indian schools who are recommended by their superintendents for special work in auto mechanics are sometimes admitted.





The tool board and tools for line 2. Fig. 9 shows line 9, where lubrication and servicing is done

trucks, six 35-passenger buses, and 8 tractors. It is unnecessary to seek private cars, although for some purposes of instruction models other than those owned by the school are brought in. A shop which owns and operates its own vehicles has several advantages. In the first place, there is no competition with outside trade. Secondly, the program can be adapted to meet the needs of individual boys within the shop. That is, jobs can be saved for particular boys who have reached a point in their progress where a specific or specialized job is needed. Third, the boy who does the major repair on the car can see whether his work stands up over an extended period of time.[6]

Description of the Shop

The plan of the shop is shown in Figure 1. There are two entrances to the shop, one at the front to admit cars to the lines; and one at the rear which not only admits cars to the automatic lift, but also serves as an exit for cars from the lines. Cars brought in for repairs are pointed toward the windows on the east side of the shop.

Under these windows are installed permanent workbenches attached to which are the tool boards containing all the tools necessary for instruction in that line. See Figure 2. The shop walls are painted black 4 feet from the floor; the remainder a light gray. Car-section lines are marked off as indicated in Figure 1. Storage facilities, a tire repair room, and a parts room are included at the rear of the shop.

The Line System of Instruction

For want of a better name, the unique method of instruction developed at the Albuquerque Indian School has been termed the *line* system, primarily because each section or line in the shop has been designated for specific divisions of the car.

The shop is divided into nine lines as shown in Figure 1.

(1) Front axle-steering and front springs; (2) brakes; (3) rear end and springs; (4) transmission, clutch, and drive lines; (5) motor tuneup, valves, carburetor, fuel pump, and ignition; (6) complete motor overhaul; (7) electrical; (8) paint and bodywork — welding and blacksmithing; (9) greasing, oiling, and general checkup.

These divisions form logical divisions of the automobile itself. When the auto mechanics have been selected and there is a full enrollment, there is a total enrollment of 18 in the class or two pupils for each line. When it is light, the minimum requirements of such a system are 9, or one for each line. Usually the number in each class is kept at 18 — the maximum capacity.

The method of selection has already been described. For this course an attempt is made to hand-pick the applicants on the assumption that auto mechanics need to be well trained both from the viewpoint of safety and of usefulness to the public. Once selected, the boys choose the first line in which instruction is to be given. Every attempt is made to satisfy their first preference. Inasmuch as each successful applicant will pass through all the lines before departure from school, there is not much advantage to this first choice. It is used as a motivating device in so far as choices can be granted. Each boy is changed from one line to the next when the instructor and his assistant consider that he has gained sufficient skill and technical information in the processes of that line or until the instructor notices a loss of interest. Whenever two boys have been assigned to the same line, one boy, usually the older and certainly the more experienced, is left in the line to help the new member to learn the skills and technical knowledge of that line. The time which each boy spends in each line depends upon his ability to master the skills and upon the number of times he has opportunity to repeat the more important operations.

The methods of instruction may be described by referring to actual cases. Let us suppose that a car has been brought in for a complete overhauling. It is broken up into eight sections. The chassis is left on line 8 — since bodywork, welding, blacksmithing, and painting may be required. The motor is detached and moved by crane to line 6. Any movable parts involving wiring are taken by the boys in line 7. The transmission and clutch are assigned to line 4, and so on. Each line does for that car the particular tasks assigned it.

In order that new boys may learn what steps to take approaching a particular job — for example, the relining of brakes — sheets have been prepared describing in logical sequence the operations to be performed. Different sheets for each make of car are available. Even the more experienced boys are encouraged to use these check sheets as a means of testing their knowledge of the order of operations. Similar check sheets are used in many commercial shops to encourage thoroughness. The head mechanic passes from line to line talking over the problems with each boy in charge. He runs through the operations with him, indicating how far he should proceed before seeking help or asking for a check on his procedures. The check sheets indicate clearly the operations in sequence for each job and at what point their work should be checked. Generally speaking, checking is done before a particular unit is enclosed so that inspection of the interior mechanism can be made.

As soon as the boys in the line complete the operation to the point of needing a check by an expert, the head auto mechanic is called. He certifies to the accuracy with which the operation has been performed. The boys then proceed with the next operation, until checking is again required. The head mechanic may inspect the equipment in the absence of the boys in which case he places a tag upon the equipment as an index of satisfactory workmanship. This tag is authority for the boys to proceed with the next operation. When the car is entirely reassembled it is taken out for a test run by the head auto mechanic who puts it through its paces. He usually takes with him one of the boys to help train him to detect difficulties in the mechanical operation of the car. If some part of the car does not operate satisfactorily, it is brought back to the lines where the original work was done. Each boy then learns to check carefully the work assigned him.

Perhaps the foregoing illustration may seem unusual. In fact, this is almost an every week occurrence in the shop described. In a num-

[6]This system, therefore, is somewhat different than that of the typical public trade school.

ber of cases, however, cars are brought in for specific repairs; the brakes need to be relined, the motor needs a tuneup, or the front wheels are out of alignment. In such cases the cars are sent to the lines where the necessary operations are performed. If the car is to be serviced it is sent to line 9 where the operations of greasing and oiling are completed.

It may well be asked what happens to boys on lines when no work is available for them. Underneath the bench in each line are the parts of three standard cars: Ford, Chevrolet, and Plymouth — parts that relate to that line only. It is customary procedure for new boys on the line to be given the opportunity to disassemble and reassemble this equipment, as shown in Figure 3. They get actual practice fitting the various parts together. This is not an unsupervised practice. Each boy is checked in the same manner as when working on an actual car. Older and more experienced boys also busy themselves with assembly and breakdown of spare parts related to their lines, or study the manuals of standard-make cars, particularly those sections that apply to their line. In some instances complete cars have been assembled by the boys in the shop and the cars sent to the farm or shops to use in transporting equipment and materials. Actually, there is very little spare time. The instructor realizes the value of real jobs and knows how dull any *made work* can become. He therefore plans this work so carefully that each boy knows what his next job will be even before his present job has been completed.

It has been assumed that three factors of learning operate in any situation. There is the skill to be learned, technical knowledge, and job wisdom. The first of these three essentials is cared for by the methods of line instruction just described. What of the other two equally important factors?

In most trade schools technical knowledge is given in related classes. It has been the practice in the present setup to relate technical information a little more definitely to the job in progress. If a boy is relining brakes and is selecting brake lining, the instructor takes the learner aside to explain the technical details of brake-lining construction, what happens when grease enters the brake shoe, the relation of hydraulics to brake manipulation, etc. This is highly individualized instruction and some have argued that it is costly in time. It is the contention of the instructors that explanation of technical details when the specific skill is learned is better teaching and that the two should not be separated either by separate instructors or by an interval of time between teaching the skill and teaching the technical basis of the skill. The instructors are well aware that this procedure slows up output. They believe, however, that the shop exists for pupils and that production is for that reason secondary. When the pupil has mastered the fundamental skills and has had opportunity to learn the technical details of the job, at that time only should emphasis be placed upon speed of production — at that time alone should effort be made to speed up operations.

Job Wisdom

The line system lends itself to teaching job wisdom. Two boys in each line must work together. They must cooperate. They learn to respect the rights of others. They must develop habits of honesty and truthfulness by the system of checking tools daily. No boys leaves the shop until the tool boards on each of the nine lines are checked. The fact that each boy is not forced to so speed up his work that he sacrifices accuracy encourages habits of thoroughness and results in less friction between pupils or between pupil and driver. Since each boy is responsible for a definite repair, he knows he must accept responsibility for the effect of his workmanship. The car or truck must perform efficiently. There is little chance to *pass the buck*.

The Instructor's Responsibilities

The functions of the head mechanic and his assistant are easily understood when one thoroughly understands the line system. They plan the work of the shop, inspect the work in each line frequently, check the work so that students may proceed with the next assignment, and give technical information as required. They also maintain contact with those governmental agencies where boys are likely to be placed. It is needless to say the success of the system, as in any other system, depends to no small extent upon the fairness, the wisdom, and the foresight of the teaching personnel.

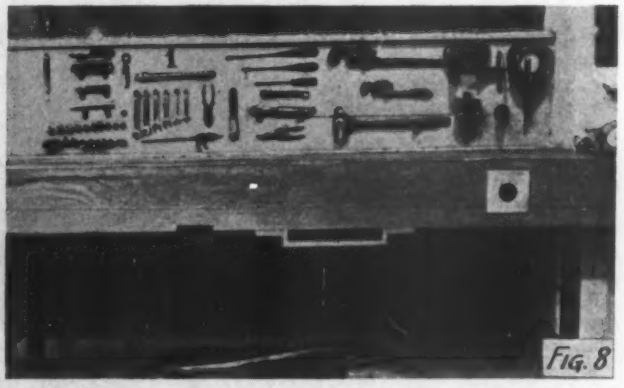
Toolroom and Tool Boards

All the ordinary tools necessary for repairs to that line are located on tool boards immediately over the bench. See Figure 4. It will be seen that each tool board has black silhouettes of each tool painted at the exact location where each tool is suspended. At the end of the working day, it is comparatively simple to check tools. The instructor or his assistant checks each line for missing tools.[7] There is, of course, some duplication in small tools. Wrenches, pliers, and screw drivers needed for one line must be purchased for other lines. This disadvantage is outweighed by the increase in speed of operation. No boy has to wait for tools. Specialized equipment is checked out by the instructor or by his representative from the instructor's supply cabinet which is usually locked.

The argument for a toolroom in order that each boy may have the experience of checking and caring for tools has been found impractical in this shop. In the first place, no boy who likes auto mechanics likes to be assigned to the toolroom; in the school shop there is not enough toolroom activity. Secondly, with this method of instruction it would be necessary for each boy to spend a longer period of time in the toolroom. Such a procedure would lessen interest. It is the contention of the writers that assignment of boys to toolrooms has been overemphasized and in this shop it would be completely out of place.

At the present time no student is assigned full time to the parts room. Again the demand is so limited that to place a boy there would result in excessive monotony. In the average school shop the stock of parts is so limited to the type of work accepted that many times the education of auto mechanics in parts-room techniques is overrated. A policy of allowing all boys in the shop access to the parts room

[7] In one year's operation the value of the tools lost was $1.65.



Indian boys repair government cars. A Navajo and a Pueblo boy are shown working together on line 1. Fig. 8 shows the tools used on line 1

for needed parts has failed to result in losses or lack of order. The only safeguard found necessary is the ruling that an assistant mechanic must accompany a student to the parts room. In this way the boy is certain to secure the proper parts and the parts room is always left in good order.

Records and Examinations

No description of a teaching device would be complete without some mention of records and examinations. Figure 5 is the shop report used in the school. The established procedure is to record the marks immediately after the job is completed. This is done in the presence of the boy. There is then no mystery attached to marks, and each boy associates his mark with the particular job done. This procedure has been found to be particularly effective as a means of motivation. There is also an opportunity for each boy to review his record any time he chooses. A rack adjacent to the instructor's desk holds the shop card of each enrollee. Do other boys compare their records with others in the class? Sometimes, and no attempt is made to prevent it. So far, there is no indication that this discourages the poorer workmen or causes those who perform well to overestimate their importance.

The card calls for two sets of marks — one for attitude and one for workmanship. This distinction has increased the value of the record for counselors and has made it clear to boys in the shops that both a desirable attitude and careful workmanship are essential for shop success. The symbols *p*, *g*, and *vg* refer to the terms *poor*, *good*, and *very good*. This three-division marking scheme has met some opposition. The shop instructors contend that a five-point classification differentiates between students more advantageously than the three-point scale in use at present, and undoubtedly their argument is sound.

Examinations are given at the end of the year. Each boy is given a list of those operations he is expected to perform in advance of the examination. The actual test consists of assembling a particular section of the car as for example, a motor, a carburetor, or a transmission. The task assigned is dependent upon each boy's progress in the shop.

Conclusions

The advantages of the system described herein may be summarized as follows:

1. The boy is taught to think for himself.
2. He learns to associate tools with the particular operation.
3. He learns effective standards of accomplishment.
4. It is easy for the instructor to discover who is most versatile in all the operations, and who has a flare for work on a particular part of a car.
5. Related information and technical instruction are given at the time it is most needed, i.e., at the time the skill is performed.
6. There is ample opportunity for repetition and drill on one operation since each boy can remain on the specific line for as long a time as is necessary.
7. Definite responsibility is fixed upon the individual both for the success of the operation and for care of tools.
8. There is no chance for the boy to shirk his job. The disciplinary problem has been practically eliminated.
9. It is possible for the instructor to adapt instruction to individual differences.

The disadvantages are as follows:

1. When a number of rush jobs are scheduled there is a tendency to stress the skills to be performed and to slight technical related instruction.
2. There is some increase in costs necessitated by the purchase of duplicate sets of small tools.

There are other disadvantages within the system that could be corrected in another situation.

1. Line 8, devoted to painting, should not be included in the regular lines. Figure 6 is a plan for a proposed shop in which this difficulty has been eliminated.
2. No system is provided by which a boy begins to make a collection of his own tools while he is being trained.
3. The doors to the present shop do not allow access to the specific lines by direct entrance. The correction of this difficulty is cared for in the proposed layout shown in Figure 6.
4. There is a tendency to limit the instruction to the cars which are available in the system. It is probable that more versatility would be gained were more cars brought in from the outside.

Interest in the line system has been evidenced by some service department heads employed by automobile dealers, although no attempt has been made to adopt it for commercial purposes. Whether this system would lend itself to the elements of production where speed and ability to produce are essential to the life of a business is problematical. It remains for someone to experiment with this system in a commercial garage.

It is recognized that the system just described is peculiar to the conditions existing in a local situation. However, it is believed that the elements of this system are applicable to other school systems in which auto mechanics is taught, and the writers believe that schools who try this system will not return to their old methods of instruction.

A COURSE OF STUDY IN DISTRIBUTIVE EDUCATION BASED ON JOB ANALYSIS

MURRAY BANKS*

The course of study in a particular subject should express the aims and objectives of that subject as it contributes to the entire sequence of courses preparing for a particular vocational field. Well-organized curriculums and courses of study, therefore, are essential for efficiency in any field of vocational education.

This article deals with the course of study offered in the cooperative course in retail selling in the Millville High School, Millville, N. J., as it grew out of a job analysis. Following the listing of the objectives of these courses of study is the schedule that was drawn up for this curriculum. The relation of the schedule or topics to the duty or job analysis will be indicated.

Subjects in the Retail Selling Course of Study

The subjects included in the distributive education curriculum were: (1) retail salesmanship, (2) principles and practices of retailing, (3) the psychology of human relations, (4) conference on store practice and job problems, and (5) merchandise information.

Retail Salesmanship

Aims and Objectives — General Objectives:

1. To develop the proper knowledges and skills of salesmanship.
2. To develop the ability to analyze merchandise qualities.
3. To develop the ability to co-ordinate merchandise knowledge and sales techniques.
4. To develop the ability to apply basic knowledge and skills of merchandise analysis and of sales techniques to new situations.
5. To develop the "sales personality."
6. To develop the desirable character traits.

Specific Objectives:

1. To teach effective selling techniques for retail selling.
2. To develop skills:
   - *a*) Sales arithmetic (selling price per unit; discount; sales checks; measurements, etc.).
   - *b*) Analyzing merchandise to determine quality.
   - *c*) Constructing selling points from an analysis of the merchandise.

Relation of Aims and Objectives to the Duty Analysis

A job analysis of 78 representative selling positions revealed a number of duties which were frequently performed. The following list of duties performed by salespeople will indi-

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cate the relationship of the aims and objectives of the course to the duty analysis.

1. Meet customers.
2. *Size up* customers.
3. Determine what customer wants.
4. Present merchandise.
5. Demonstrate goods.
6. Meet objections to merchandise.
7. Help customer select right merchandise.
8. Convince customer.
9. Close the sale.
10. Try to increase average sale.
11. *Talk up* merchandise.
12. Write sales checks.
13. Calculate what the customer is to pay.
14. Figure sales tax.
15. Keep record of sales.
16. Make change.
17. Meet objections to firm.
18. Handle phone orders.
19. Give prices and estimates over phone.
20. Wait on several customers at once.
21. Phone customers about *specials*.
22. Recommend services, such as credit, etc.
23. Make service calls.
24. Operate cash register.
25. Keep records of returns.
26. Write register error slips.

Abilities Involved in Selling

A person employed in saleswork requires the following abilities.[1]

1. Social abilities necessary for making satisfactory business contacts:
   - *a*) Ability to appraise correctly the people with whom he has business relations, including customers, his employer, and his fellow workers.
   - *b*) Ability to talk and act in a pleasing manner.
   - *c*) Ability to speak good English.
   - *d*) Ability to present a good appearance.
2. Abilities needed in aiding customers to solve their buying problems:
   - *a*) Ability to render to customers the kind of selling service they need by helping them:
     - (1) To define their wants in terms of goods available.
     - (2) To select goods that will satisfy their wants.
     - (3) To overcome any seemingly insurmountable buying obstacles.
   - *b*) Ability to show customers how they can use to advantage the goods the store has in stock.
   - *c*) Ability to render auxiliary selling services that will build good will for the store.
3. Abilities necessary to handle goods and services sold:
   - *a*) Ability to learn how the goods sold in the store may meet the needs of a wide variety of customers and how to present to customers the value of goods for their purposes.
   - *b*) Ability to handle the goods so as to display their qualities effectively.
   - *c*) Ability to act as an efficient member of a distributive system.
4. Store-service abilities of value to the salesperson:
   - *a*) Ability to conform to the organization, practices, and policies expressed in the rules, regulations, and working instructions of the employer.
   - *b*) Ability to read, write, and compute rapidly and accurately.
   - *c*) Ability to handle the goods he sells so as to prevent loss, insure safety, and facilitate service.

Topics Covered in Retail Salesmanship

1. Selling as a vocation.
2. Training to improve the salesman's attitude or personality. This involves:
   - *a*) Helping the salesman to develop enthusiasm for his job.
   - *b*) Determining and developing the qualities of a well-integrated selling personality.
   - *c*) Setting standards of personal appearance.
3. Training to increase the salesman's knowledge of his merchandise and store. This involves:
   - *a*) Facts about the store and its policies.
   - *b*) Facts about the merchandise; its materials and manufacturing processes.
   - *c*) The points of superiority of the merchandise; its selling or *buying* points.
   - *d*) Facts about the stock carried.
   - *e*) Facts about the uses and care of the merchandise.
   - *f*) Facts about competition.
4. Training to increase the salesman's knowledge of customers. This involves:
   - *a*) A study of what makes people buy.
   - *b*) Creating effective appeals.
   - *c*) The problem of classifying and handling customers.
5. Training to improve the salesman's selling technique. It involves:
   - *a*) The successful approach.
   - *b*) Planning and using an effective presentation.
   - *c*) Meeting the customer's objections and securing conviction.
   - *d*) Closing the sale.
   - *e*) Increasing the sales through effective suggestion.
6. Store system.
7. Recording the sale (selling arithmetic).
8. The salesperson's nonselling duties and responsibilities.
9. Care of merchandise.

Principles and Practices of Retailing

Aims and Objectives — General Aim:

To give students a general knowledge of the organization and function of various types of retailing establishments, so that they might develop a more intelligent understanding of the retail field and its problems.

Specific Aim:

To show those students who are in retailing the advantages of one type of establishment compared to another and to give them enough of the techniques and store operation to help them determine the particular branch of the retail business they might care to specialize in, in addition to a well-rounded perspective of retailing principles and practices.

Relation of Aims and Objectives to the Duty Analysis:

1. Take inventory.
2. Report markdowns.
3. Keep record of returns.
4. Mark price tickets.
5. Keep want slips.
6. Rearrange counters.
7. Clean and arrange display shelves.
8. Keep reserve stock complete.
9. *Size* stock.
10. Receive and mark merchandise.
11. Write copy.
12. Make signs.
13. Aid in making window displays.
14. Address sales promotion cards.
15. Write good-will letters.
16. Hire employees.
17. Make adjustments.
18. Write requisition for supplies.
19. Check reserve stock.
20. Make out bank slip.
21. Turn in money to office.
22. Accept and approve checks.
23. Give discounts.
24. Put away incoming stock.
25. Mark stock.
26. Report slow selling merchandise.
27. Inspect incoming merchandise.
28. Remove and distribute merchandise.
29. Give training to other employees.
30. Confer with employer about customers.
31. Confer with employer about credit.
32. Confer with employer about policies.
33. Do comparison shopping.
34. Receive salesmen.
35. Write reorder letters to manufacturers.

Topics Covered in Retail Principles and Practices

1. The meaning of retailing.
2. Types of retail stores.
3. Store location, structure, layout, and equipment.
4. Store organization.
5. Principles of merchandising.
6. Receiving.
7. Marking.
8. Stock turnover.
9. Inventory.
10. Retail advertising.
11. Sign writing.

[1]Derived from Kenneth B. Haas's *Distributive Education* (New York: Gregg Publishing Company, 1941), pp. 16–17.

12. Floor, counter, and window display.
13. The consumer point of view.
14. Efficient customer service.
15. Personnel management in retail stores.
16. Store finance and accounting.
17. Credits and collection.
18. Current trends in retailing.

The Psychology of Human Relations

Aims and Objectives — General Objective:

To develop the student's knowledge of people so that he may more successfully adapt himself to the various situations involving social contact and social learnings.

Specific Objectives:

1. To give information that will aid students to know what to look for and to be aware of when seeking social stimuli.
2. To help students interpret these stimuli more successfully than they otherwise would.
3. To help students appraise correctly people with whom they will have business relations, including buyers, employers, employer representatives, fellow salespeople and employees who are subordinate to them.
4. To adopt a pleasing manner in meeting those with whom they come in contact in their work.
5. To show students how to control their conduct so as not to reveal any feelings or emotional reactions that are annoying to others.
6. To show students how to determine whether they have succeeded or failed in their efforts to improve their social ability.
7. To help students receive practice in making social adaptations in their store activities.
8. To help students analyze the ways and means by which they can be successful in their business-social contacts.
9. To plan and direct a sequence of the social contacts that the learners are to study.
10. To help students select new goals and stimulate them in their efforts to attain these goals.

Relation of Aims and Objectives to the Duty Analysis:

1. *Size up* customers.
2. Make adjustments.
3. Make exchanges.
4. Meet objections.
5. Handle customer complaints.
6. Handle phone complaints.
7. Wait on several customers at once.
8. Handle customers with relief stamps.
9. Notify customers when promises must be broken, etc.
10. Give training to other employees.
11. Help other employees.
12. Confer with employer about progress.
13. Cooperate with employer and employees.
14. Hire employees.
15. Receive salesmen.
16. Write good-will letters.
17. Confer with employer about credit.
18. Wait on other salespeople's counters.
19. Run errands for employer and employees.

Conference on Store Practice and Job Problems

Objective of Conferences on Store Practice:

This course provides for special discussions which aim to aid the student to understand and interpret correctly current problems and needs of the trainees as they arise in the course of their store experiences. Conferences are held on such matters as these:

1. Sales techniques.
2. Consumer problems.
3. Merchandise information.
4. Fashion.
5. Phases of economics and business law as they relate to retailing.
6. The personality of the salesperson.
7. Dress and decorum.
8. Courtesy in business.
9. The ethics of business.
10. Employee-employer relationships.
11. Opportunities for growth on the job.

Shortcomings in arithmetic, spelling, penmanship, vocabulary, pronunciation, telephone technique, effective speech, approved English usage, etc., are overcome by conferences, discussions, and individual drills rather than by class lecture methods.

Merchandise Information

Aims and Objectives — General Aims:

A thorough study of merchandise (textiles and nontextiles) has many values for the student. First, as a consumer, the student will be better equipped to purchase merchandise at better values. Second, from the standpoint of the salesperson, this course attempts to actually increase the earning power of the trained student.

Specific Objectives

The more specific aims of this course are:

1. To develop rational bases for evaluating merchandise offered for sale.
2. To develop a merchandise background of textile and nontextile commodities for purposes of more successful selling.
3. To learn how the manufacturing and finishing processes affect the style, quality, and price of the merchandise.
4. To provide a general foundation of knowledge concerning commodities and techniques for analyzing pertinent features of merchandise.
5. To learn the satisfaction possibilities of the goods offered for sale.

Relation of Aims and Objectives to the Duty Analysis:

1. Know how the product will perform.
2. Know what it is made of.
3. Know the uses of the product.
4. Understand labels on merchandise.
5. Interpret meaning of labels.
6. Know quality.
7. Know launderability of merchandise.
8. Know construction details.
9. Know points of superiority.
10. Know sources of products.
11. Know colors.
12. Know styles.
13. Know standards.
14. Know assortments.
15. Know how to care for products.
16. Know competing goods.
17. Know price lines available.
18. Know sizes.

Topics Covered in Merchandise Information

1. Sources of information on merchandise.
2. Divisions and classifications of merchandise.
3. Information on textiles.
4. Information on nontextiles such as hardware, furniture, furs, cosmetics, etc.
5. Art in merchandise.
6. Color line and design, and fashion.
7. Familiarity with merchandise manuals.
8. Trade literature.
9. U. S. government publications of interest to retailers.
10. Importance of care of stock.

Hours for School Instruction:

School instruction is offered to the cooperative part-time trainees for four periods daily. Of these four periods, two periods were devoted to the related instruction as outlined above.

School Instruction As Contrasted With Store Training

In discussing the content of the course of study it should be kept in mind that the instruction offered by the school is concerned with basic background information as well as with specific job training. In speaking of learning activities, which should be directed by the school on the one hand and by the store on the other, in terms of needs rather than in terms of courses, one writer[2] lists the following needs of the student while in school and in the store:

a) Training needed while in school. Training in personal regimen; in conversational English; in selling; in fundamentals of arithmetic; in basic merchandising information; in elements of color, form, and design; in retail organization, function, economics, and requirements; and in applied spelling.

b) Training needed while in store. The training needs which may be met by the store in which the pupil is employed are as follows: training in policies, regulations, and privileges of membership in the organization; training in the store systems; in particular jobs; in special merchandise information; in special salesmanship practices; for promotion; and for more efficient performance of duties.

Although some of the topics listed for training in the store are similar to those listed for training in the school, in the store the topics are presented from the standpoint of the specific training needed in the particu-

[2]Derived from A. Mortz, "What Salesmanship in High Schools?" *Journal of Business Education*, April, 1933.

Writing Objective Tests for Shop Instruction[1]

FRANK C. MOORE* and WILLIAM R. MASON**

One of the most interesting and useful tools of instruction, and possibly the one most misunderstood by many teachers, is testing. This misunderstanding is due to the fact that teachers in general do not study the possibilities of a test. The result is that much testing goes on for no good purpose but simply *to test*. What should be measured is of first importance. Next, teachers must be sure that what is tested is measured with the same scale, that is, ability with ability or knowledge with knowledge. If this is not done, the result will be as unsound as the comparison of inches with gallons.

Everything that is done, or that exists at all, exists in some amount and can be measured. Teachers may not know at the moment just how this measurement should be accomplished, but they should be able to discover a way with enough study. In all, there are many problems which complicate the problem of better testing.

Realizing this fact and that everyone cannot be expert in all fields of instruction, we include here suggestions for writing tests of the objective type. These suggestions are not new or original, but have been compiled from various sources and were used by committees of shop teachers in Cleveland as a basis for revising their tests. The test samplings included in this article were not selected for the questions asked, but to show the application of the rules set down. They have been carefully studied. For example, word blanks made thus ...?... are suggested in this form to prevent the disclosure of long or short words in the answers. A column of correct answers should be offered in order to keep the test objective, capitalizing each to prevent disclosing proper names. They should also be alphabetized; single spaced between like letters and double spaced where a new letter starts, to set off blocks for ease in locating the word sought. In all, each detail of the samples bears study for they are shown, as pointed out, in their particular form because they meet the principles and suggestions outlined in this article.

[1]This material on testing was developed by Mr. William R. Mason, as consultant for curriculum revision in industrial arts. It has been used effectively the past three years as a guide to teachers. Because of its usefulness and application to all subjects, it is submitted in the hope that its publication may prove of value.

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Uses of Tests

A. *To stimulate learning:* Short ten-minute tests given regularly upon the completion of the various phases of instruction emphasize and distinguish points of importance for the pupil. It is found that pupils discuss such questions freely and with interest when they understand that the teacher is using them for the purpose just stated. Teachers of younger pupils find that tests may be used effectively in the form of games or puzzles. The matching test is especially well adapted to this purpose.

B. *To reveal strengths and weaknesses of teaching:* This seems to be the real and most important use of tests. We may say that no test should be given without a follow-up of the correct answers, or at least a comparison of class results which will indicate to the teacher items which need reteaching.

C. *To measure achievement:* This is the older, and in too many cases the single use, which teachers make of tests. The emphasis here is on grades and grading systems. The up-to-the-minute teacher prefers to place the emphasis on the measurement of the strengths and weaknesses of his teaching.

D. *To predict success in a given field:* This is the least highly developed use of tests and yet offers the greatest challenge to teachers of industrial subjects. All of the prognostic, mechanical aptitude, mechanical ability, and dexterity tests may be included as types used for this purpose.

Requirements of a Good Test

There are two important requirements which must be met by any test.

1. It must be valid — that is, it must actually measure what is to be found.
2. It must be reliable — that is, it must give consistent results. It should give the same measurement for a pupil's ability whenever the test is applied.

The Criterion of Mechanical Ability

If one attempts to test for mechanical ability, he should be sure to measure for quality, quantity, creativeness in mechanical work, and mechanical sense or an appreciation of mechanical work.

1. *Quality:* Mechanical ability should be judged by the product. It is either good or bad. Has the pupil met the specifications? Is his general finish of high quality? Is his workmanship good in the various operations?
2. *Quantity:* Practice, motivation, interest, and working conditions being equal, the person who can turn out the most work in a given period of time possesses the greatest mechanical ability.
3. *Creativeness in mechanical work:* This is problem solving of a special kind and should be recognized. Creativeness may take the form of ability to plan, invent, or design. It might also be the utilization of by-products or substitution of suitable materials.
4. *Appreciation of mechanical work:* This is quite all inclusive. It may be represented by the possession of relevant information, by the ability to form correct judgments, or by the ability to see an operation or product in its proper relationships.

Construction of Informal Objective Tests in General

Directions to guide in the making of questions:

1. Make all questions involve only the important facts covered in the unit.
2. Make the examination comprehensive.
3. Avoid catch questions and ambiguous statements.
4. State questions simply and directly.
5. Keep test objective by avoiding questions that have more than one answer.
6. Place questions in groups according to form or type.

a) Introduce each type with directions.

b) Give a sample question and answer with each type.

General rules:

1. List important topics as determined by the aims and objectives of the course.
2. Subdivide these topics.
3. Write questions based upon these topics. Write the questions in any form and make up at least 50 per cent more than can be used.
4. Change questions into the form which suits them best, and group as to types.
5. Decide upon the length of the test.

a) Arrange items in order of difficulty. The average pupil should get about one half of these correct.

b) Do not require pupils to do much writing.

c) If an entire examination is made up of several types of tests, be sure each type is properly grouped and labeled. The total examination may be taken at different times.

6. Put the test aside for a few days or have another teacher go over it if possible. Then rewrite it.

Administration and Scoring of Tests

1. Give the class clear directions covering the test.

2. Arrange pupils so that the temptation to cheat is eliminated.

3. If possible, use a scoring key.

4. After a test, return the papers and discuss the questions. Do not let the pupils keep the papers.

5. In grading, mark the total errors. (*a*) Throw out unsatisfactory or misinterpreted items. (*b*) Grade all papers with the same system.

Types of Tests

1. *Completion Test*

A completion test is one in which blank spaces are left to be filled in with words, sentences, or statements. This is usually a recall type of examination. It is made more objective, however, by listing a column of correct answers. Any statement or question may have one or more blanks which are to be filled. Mechanical drawings which need various lines to complete them may be classified under this type of test. Completion tests have high reliability. Following are suggestions on their essential elements:

a) Prepare a list of important statements and then mark out significant words.

b) Be sure sentences are complete enough to give a clear meaning. The eliminations, however, must not be too slight.

c) Each blank should represent a word.

(1) Make all blanks the same size. A good form is made thus: ...?...

(2) Where two or more words are desired in a single space, use dashes to represent each word desired.

(3) Try to have all blanks near the end of a sentence.

d) Answers should be arranged in *alphabetical* order with *double spacing* between groups of words beginning with different letters.

(1) Capitalize all answers so as to avoid giving away answers consisting of proper names.

(2) Give approximately one third more answers than questions.

(3) Add (s) after an answer, i.e., element(s) — to provide either singular or plural form without revealing the correct answers.

e) Fifteen questions seems to be about the maximum for each page. If more questions are used for a test, include answer column complete with one third more answers for *each page*.

f) Be sure to test only the subject matter which has been covered.

g) Passages from a text should not be used.

h) Methods of answering.

(1) By writing directly in the blank space.

(2) By answering on the right-hand margin in spaces prepared.

(3) By answering on spaces provided on an answer sheet. This is most economical. See sample included.

i) Students can fill approximately four blanks per minute.

j) The correct score is simply the number right.

Suggested Sample Form

This Is a Completion Test
on
Foundry

Directions: Consult the list of *Correct Answers* to find the word or words necessary to make each statement complete and true. Words not in the list of correct answers are wrong. Correct answers may be used more than once. Write your answer on the answer strip on the line corresponding to the question.

Example: A sieve used for sifting sand is a ...?... — *Answer Strip:* riddle

Correct Answers

Alloy(s)
Cast iron
Cupola
Core(s)
Draft
Dropout
Riddle
Riser
Soldier(s)
Sprue hole
Skin
Spout

1. Bodies of sand in the cope are reinforced with ...?....
2. Metal is poured into the cope through an opening called ...?....
3. Drying the surface of a green-sand mold is ...?... drying.
4. The taper given to a pattern to enable it to be drawn from the sand is known as ...?....
5. A combination of metals melted together are ...?....
6. Holes or openings through castings are ...?....
7. A furnace used for melting iron is called ...?....

2. *Precise-Thinking Tests*

This is a relatively new type of test which was designed to overcome the criticism which teachers have of the old true-false test. In the true-false test, pupils have a 50-50 chance of guessing the answer correctly; in the precise-thinking test this chance is cut to one in eight. Such a test covers simple elements only, but will cover them well. In a test of 15 questions, 45 answers will be called for. Following are suggestions on precise-thinking test elements:

a) Avoid long statements as well as those which are ambiguous or trivial.

b) Do not use statements which suggest correct answers nor which are too obvious.

c) Make approximately half of the items true and half false. However, any or all of the items in one statement may be given as true or false.

d) In answering, use + and O. These take less time to write than writing true or false. The O is also better than using —.

e) In scoring use a key. No question is marked right if any part is missed.

f) Have pupils use the answer strip (see sample).

Suggested Sample Form

This Is a Precise-Thinking Test
on
Machine Shop

Directions: There are three parts to each question. Any part may be true or false. Mark each true part with a + and each false part with a O. Write your answers in the proper spaces provided on the answer strip. In scoring, no question is marked right if *any part* of your answer is wrong.

Example: In lathe work, the dead center is hard; revolves with the spindle; is removed with the hand wheel. — *Answer Strip:* +O+

1. Before starting the shaper, it is well to set the tool for depth of cut; be sure the ram has clearance; be sure the work is held tightly.

2. Increasing the length of stroke increases: the cutting speed; the number of strokes per minute; the feed per stroke.

3. The cutting speed may depend upon: the type or kind of cutting tool; the material to be cut; the depth of the cut.

3. *Multiple-Choice Tests*

This form of test question is hard to make, but is very acceptable to students. It is also easy to grade. While multiple-choice refers to two, three, four, five, or more answers from which to choose, four of five answers are required for desirable objectivity. Use the same number throughout the test. This is a recognition type test and is easier than the recall type. Following are suggestions on multiple-choice test items.

a) The right answers should be placed in chance order.

b) The number of choices should be four or five.

c) All answers should seem plausible.

d) To increase reliability, the number of questions should be large — 100 if possible.

e) When *negative* statements must be used, they should be underlined.

f) The multiple-choice test is sometimes used in the plural form, that is, two or more answers are to be marked.

g) There is a certain amount of guessing which goes on in all tests. The multiple-choice test is somewhat less reliable than the recall type but more reliable than the true-false. To offset guessing, use the formula: Score = rights minus wrongs divided by $(n-1)$ where n = number of responses in the test item. $\left(S = R - \frac{W}{(n-1)}\right)$.

h) Credit is not given for two or more answers when only one is required.

i) There are several methods of answering:

(1) Underscore correct answer.

(2) Put correct answer in parenthesis.

(3) Place *capital* letters before each choice.

The capital letter before the correct choice is placed on the answer strip (sample given). Capital letters have advantages over numbers or small letters in that they are easier to read in grading and less likely to be poorly made by the pupil.

Suggested Sample Form

This Is a Multiple-Choice Test
on
Auto Mechanics

Directions: Place the capital letter which is in front of the *best* answer on the line corresponding to the question on the answer strip.

Example: The ratio of the clutch shaft to the transmission shaft, when the car is being driven in low gear, is approximately: (a) 1 to 1; (b) 3 to 1; (c) 5 to 1; (d) 7 to 1; (e) 10 to 1. *Answer:* b

1. Too wide a gap in a spark plug will cause: (*a*) missing at high speeds; (*b*) the motor to start hard; (*c*) sparking outside the plug; (*d*) carbon to form; (*e*) burning of the porcelain.

2. Crank case gaskets are made of: (*a*) copper; (*b*) cork; (*c*) asbestos-lined copper; (*d*) paper; (*e*) brass.

3. Too lean a mixture (carburetor) causes: (*a*) engine fluctuation or "roll"; (*b*) slow idling; (*c*) overheating; (*d*) burning of points; (*e*) carbon.

4. *Matching Tests*

Because of the difficulty of construction, this form of test is not used as much as it deserves. It is an excellent device for testing knowledge of cause and effect. Another use of this type of test is the matching of pictures or numbered parts on a picture with their names, such as tools or machine parts. The effectiveness of the test is enhanced by listing more answers than there are questions to be "matched." Following are suggestions on match items.

a) Answers and questions are usually arranged in column form.

(1) Answers should be capitalized and listed in alphabetical order.

(2) Group words starting with the same letter, i.e., single space between all words starting with *a*. Double space between the next group, etc.

(3) Answers may also be preceded by a capital letter which may be placed on the answer strip instead of the word.

b) Not more than 15 or 20 items should be used. If more are desired, they should be arranged in sections as the location of answers takes too much time in one long test.

c) Clues must be avoided, such as having some words in plural form in both question and answer column.

d) Stick to the rule of listing one third more answers than questions.

e) To make up this test, develop a series of short statements of fact. Separate these into column form and arrange question half in chance order.

f) To score, give credit only for the number of correct answers.

g) Tools, samples, or materials are sometimes set up where a class can see them. Numbers or letters are placed on each and these then used as a form of matching test.

Suggested Sample Form

This Is a Matching Test
on
Machining Terminology

Answer Strip

Example: Intentional difference in dimensions. A

Correct Answers

A. Allowance	
B. Angle	1. Class 1
C. Basic size	2. Class 3
D. Free fit	3. Close approximation to a standard
E. Limits	4. Exact theoretical size
F. Loose fit	5. Extreme permissible dimension
G. Medium fit	6. Variation permitted
H. Nominal size	
I. Pitch	
J. Tolerance	
K. Triple	

The Answer Sheet

The sample answer sheet which follows is designed to be used with each of the four tests described in this article. It is printed or mimeographed in the form shown and then cut into strips.

The answer strip has many advantages:

1. First of all, it saves a great deal of paper and test sheets.

2. It may be noted that on none of the sample tests given are the answers marked directly on the test sheet.

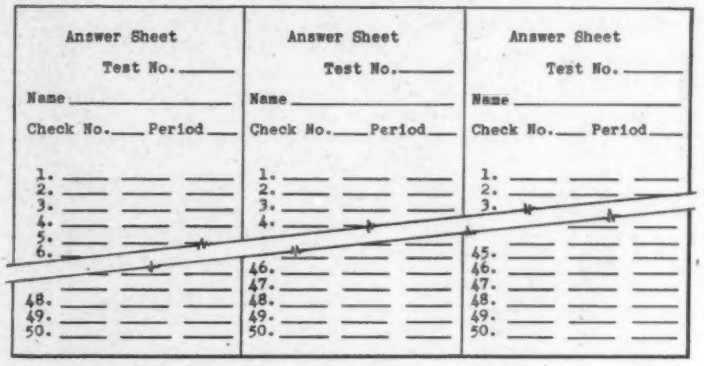
3. An answer key may be used easily with the answer strip.

4. Comparison of class results are also easy as the narrow strips may be spread out in such a way that questions missed readily stand out.

Test No. 1

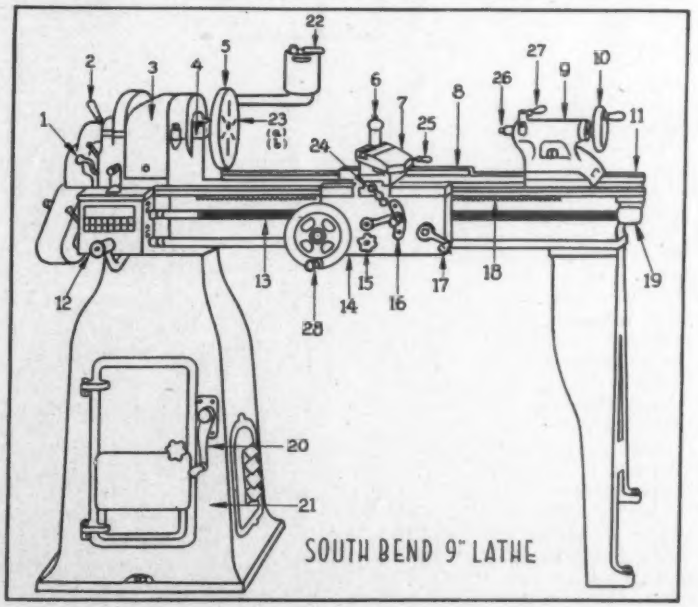
This is a matching test and covers the names of the lathe parts.

Directions: Inspect the lathe drawing, then read the names of the parts carefully. Place the capital letter which designates the correct name on the answer sheet beside the number.



Answer sheet

A — Adjusting screw lever
B — Apron
C — Apron clutch
D — Back gear lever
E — Compound feed
F — Compound rest
G — Cross-feed lever
H — Cross-slide gib
I — Cradle



J — Dead center
K — Faceplate
L — Gear guard
M — Hand-feed wheel
N — Headstock
O — Lathe bed
P — Lead screw
Q — Lead-screw bearing
R — Lever-thread cutting
S — Live center
(1) Lathe center
(2) Sleeve
T — Motor housing
U — Power-feed lever
V — Power lever
W — Quick-change gearbox
X — Rack
Y — Reverse for threads and feeds
Z — Saddle
AA — Spindle cone
BB — Starter switch
CC — Tailstock
DD — Tailstock clamp
EE — Tailstock clamp handle
FF — Tool post
GG — Vertical feed lever

ORTHOGRAPHIC PROJECTION — IDENTIFICATION OF PLANES, ELEVATIONS, AND PROJECTIONS

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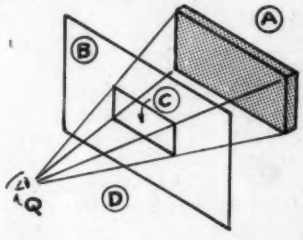
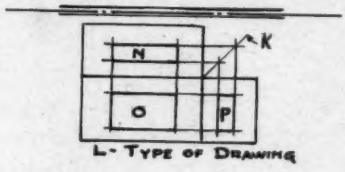
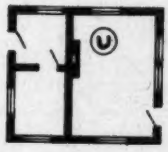
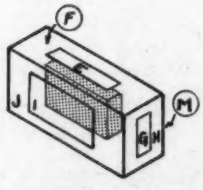
Directions: Below are illustrations showing certain items indicated with letters. Opposite the name in the accompanying list, place the letter of the one best suited in the space provided. The sample is correct.

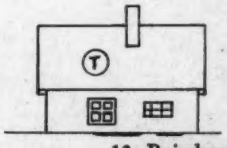






R- TYPE OF DRAWING





Sample: *N* — Top view

.... 1. Architectural drawing
.... 2. Eye
.... 3. Front elevation
.... 4. Front view
.... 5. Horizontal projection
.... 6. Horizontal plane
.... 7. Object
.... 8. Orthographic drawing
.... 9. Perspective
.... 10. Profile plane
.... 11. Plan view
.... 12. Picture plane
.... 13. Projection cage
.... 14. Profile projection
.... 15. 45-deg. projection line
.... 16. Side elevation
.... 17. Side view
.... 18. Vertical plane
.... 19. Vertical projection
.... 20. Visual rays

PREFLIGHT AVIATION TEST

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Unit VI — Meteorology

1. The higher the altitude the ..... the pressure.
2. The higher the altitude the ..... the temperature.
3. Pilots cannot live without additional oxygen over ..... feet.
4. Meteorology is the study of .....
5. The prevailing westerlies generally blow in the ..... zone.
6. The doldrums are ..... located at the .....
7. High-pressure areas are caused by .....
8. Low-pressure areas are caused by .....
9. Air rotates ..... into a low-pressure area and ..... out of a high-pressure area.
10. ..... clouds are formed by rising thermal currents.
11. The dew point is the temperature at which the relative humidity is about .....
12. Raindrops thrown up by convection currents form .....
13. The highest clouds formed in the sky are called .....
14. ..... clouds will often form with great vertical development.
15. Cloud layers are known as .....
16. A cumulus cloud developing an anvil head indicates .....
17. A radiosonde is used to gather date .....
18. An anemometer measures .....
19. The ceiling is measured by sending aloft a balloon and .....
20. One degree of temperature centigrade is ..... than one degree fahrenheit.
21. An isobar is a line connecting points of equal .....
22. An isotherm is a line connecting points of equal .....
23. The most dangerous icing conditions are usually found when passing through a .....
24. When the barometric pressure at an airport is low the pane will need more runway to take off because the .....

Key

1. Less
2. Lower
3. 20,000
4. The weather
5. Temperate
6. Rising masses of hot air; the equator
7. Sinking cold air
8. Rising warm air
9. Counterclockwise; clockwise
10. Cumulus
11. One hundred per cent
12. Hail
13. Cirrus
14. Cumulus
15. Stratus
16. Rain
17. Of the upper air
18. Wind speed
19. Timing the ascent
20. Larger
21. Pressure
22. Temperature
23. Cold front
24. Air is thin and the lift will be less

PREFLIGHT AVIATION TEST

HAROLD THEODORE GLENN
David Starr Jordan High School
Long Beach, Calif.

Unit VII — Avigation

1. Lines running through the poles and crossing the equator at right angles are called meridians of .....
2. Lines running around the earth parallel to the equator are called parallels of .....
3. The best map projection for aerial avigation is called the ..... projection.
4. The best map projection for naval navigation is called the ..... projection.
5. A great circle route is a straight line on a ..... projection.
6. Name the five most important instruments necessary to avigation:
   1. ..... 4. .....
   2. ..... 5. .....
   3. .....
7. Dangerous mountain elevations are shown on aerial maps by contour lines and .....
8. Avigation by landmarks and contact flying is known as .....
9. Avigation by accurate figuring of time and distance when laying out a course is known as .....
10. If the true course is 90°, the variation 2°E and the deviation 3°E, what should the compass heading be? .....
11. If the true course is 305°, the variation 4°W and the deviation 4°E, what should the compass heading be? .....
12. The radio compass is actually a rotational loop which when turned in the proper direction will indicate a ..... position.
13. Locating a position by means of the stars is called .....
14. The instrument used in getting a sight on a star is called .....

Key

1. Longitude
2. Latitude
3. Lambert
4. Mercator
5. Lambert
6. Compass; air speed indicator; altimeter; drift indicator; chronometer
7. Color
8. Piloting
9. Dead reckoning
10. Eighty-five degrees
11. Three hundred five degrees
12. Null
13. Celestial navigation
14. Sextant

Problems and Projects

HOW TO USE A FILE

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1. Before starting to file, make sure that the file is clean. If it is dirty, clean it with a file card as shown in Figure 1. A nail is a good substitute if a card will not remove the dirt.

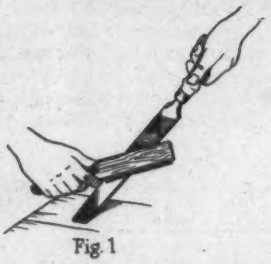

Fig. 1

2. If a new file is used, rub chalk on the teeth to keep them from clogging.

3. Never use a file without a handle.

4. Grip the work firmly in the vise with the surface to be filed projecting slightly above the vise jaws as shown in Figure 3.

Fig. 2

Note: To avoid marring the work, place a piece of sheet metal between the work and the vise jaws as shown in Figure 2. Avoid filing into the vise jaws as they are hardened and will damage the file.

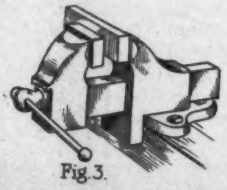

Fig. 3

5. Grasp the handle of the file in the right hand and place the thumb of the left hand on top of the file with the remaining fingers curling under the file as shown in Figure 4.

6. Do not grasp the file too firmly. A light grip will give the best results.

7. Stand with the left foot pointing toward the bench and the right foot back of the left foot.

8. Keep the file flat or the work will be rounded when it should be flat.

9. Take long strokes with the file, using the entire length of the file in each stroke.

10. Throw the weight of the upper part of the body on the file, thus moving it on the forward stroke.

11. On the back stroke lift the file and observe the work of the last forward stroke and plan the next stroke.

12. Examine the file frequently to see that it is free of dirt. A dirty file will cause deep scratches to appear on the filed surface.

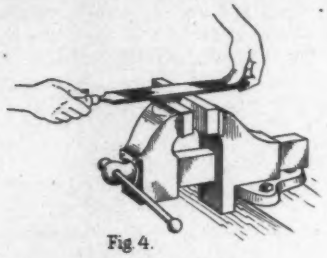

Fig. 4.

Don'ts in Filing

Don't use a loosely fitting handle.
Don't use a worn-out file.
Don't use a new file on narrow edges.
Don't use a good file on cast-iron scale.
Don't use a fine file for filing soft metal.
Don't use a bastard file for finishing.
Don't use a smooth file for roughing.
Don't allow files to scrape together.
Don't put your fingers on the cast-iron surface being filed.
Don't push the file too fast.
Don't file too much before testing the work.
Don't file into the vise jaws.

References: Burghardt, Henry D., *Machine Tool Operation* (New York, N. Y.: McGraw-Hill Book Co., Inc.); Jones, Harry A., *Machine Shop Practice, Book I* (Milwaukee, Wis.: The Bruce Publishing Co.).

BAG HOLDER

LOUIS M. ROEHL

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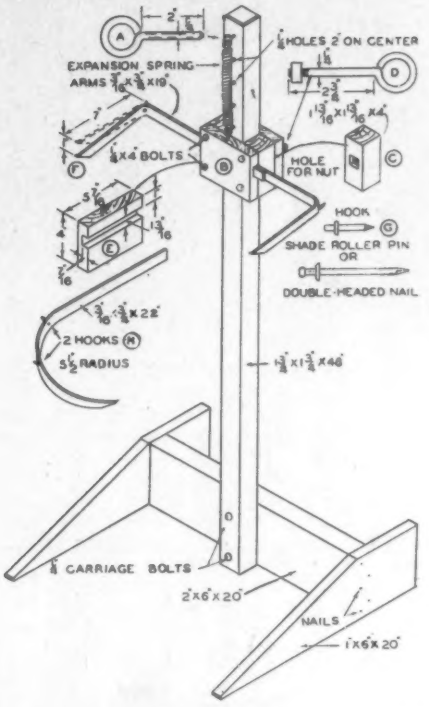
Ithaca, N. Y.

The bag holder described herewith takes the place of a man or boy, hence saves labor, is adjustable to any length or width of bag, holds bags wide open, is fitted with a spring to let the beg down as it is being filled, does not tear bags, and provides a way to remove bags without lifting.

The bag holder shown is inexpensive and so simple in construction that it can be made with tools and material usually found on farms, or is easily obtainable.

The base consists of a 2 by 6 by 20-in. piece, at each end of which is a 1 by 6 by 20-in. board nailed at right angles. The front ends of the boards are tapered to provide space for the bag. A 1 by 6-in. board may be nailed at the top of the base back of the post if deemed necessary to further stiffen it.



Bag holder

The post consists of a 1¾ by 1¾ by 48-in. piece. For this a piece of 2 by 2-in. material is used. It is attached to the 2 by 6-in. piece with two ¼ by 4-in. carriage bolts. Six ¼-in. holes are bored 2 in. apart on a center line at the upper end of the post for the eye pin (A) that holds the holder on the post.

The slidable head (B) consists of four pieces of wood held together with four ¼ by 4-in. carriage bolts. The two middle blocks are 1 13/16 by 1 13/16 by 4 in. They need to be 1/16 in. thicker than the post to provide for its free up-and-down movement. In one of the 1 13/16-in. pieces a square hold is made as big as a ¼-in. nut, as shown at C, for the armlocking eyebolt D.

The other two pieces are ¾ by 5 7/16 by 4 in. In the front one (E) a slot 7/16 by 13/16 in. is made for the arms to slide in. The slot needs to be 1/16 in. wider and deeper than the thickness and width of whatever size of iron is used for the arms.

The pieces are assembled with the ¾ by 4-in. carriage bolts.

The arms are made of iron 3/16 by ¾ by 19 in. One end of each arm is cut at a slant and the tip is bent up as shown at F. It is then bent 7 in. from the end, as shown at F. Two hooks are made from shade-roller pins or double-headed nails as shown at G. Holes are

Filling a bag

drilled at the bend of the arms and the pins are inserted and riveted in place. They are then cut to ⅜ in., or ½ in., filed to shape on the underside, and bent up slightly.

If the holder is to be used in filling bags with cabbage or other bulky produce, a larger pair of arms, 22 in. long and bent as at H, is better.

Arm Adjustment

The arms slide in the head and are held in place with a ¼-in. eyebolt D. A ¼-in. hole is bored in the head in line with the square hole. Slight turning of the eyebolt forces its end against the arms and holds them in place.

Vertical Adjustment

The vertical adjustment is made by placing the eye pin (A) at a hole in the post as determined by the length of the bag. One end of the expansion spring is attached to the eye pin and the other to the upper end of the slidable head with a screw eye. The spring lets the head and arm assembly down as the bag is filled. A spring 1 in. in diameter and 6 in. long is usually satisfactory.

WINGS FOR THE BEGINNER

WILLIAM E. HUSS

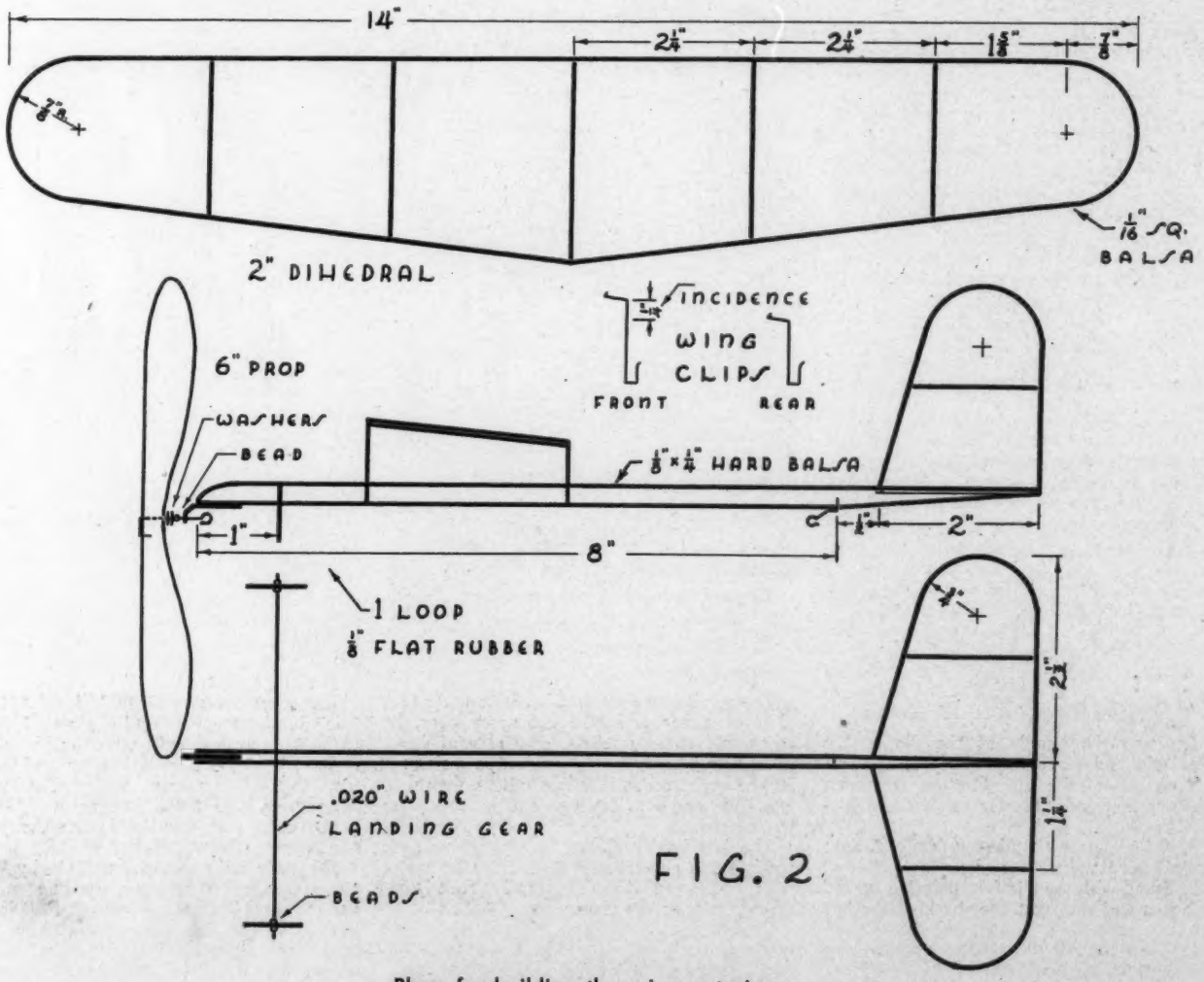
Instructor, General Metal
State Teachers College
Oswego, N. Y.

Model airplanes designed for beginners must be simple to build and sure to fly. The teacher of model-airplane classes must search for designs that will fulfill this need because the success of the program in many cases depends on the types of planes selected for construction.

The designs used in aeronautics classes will reflect the purposes for which the group is striving. If the model airplanes selected are complicated in structure, they can best achieve the objective of developing skills in the manipulation of balsa wood, glue, and paper. However, other objectives of greater importance to the present "air-conditioning" program are being stressed in our schools. These can be summarized as follows:

First, to gain experience and understanding of aeronautics through the flying and adjusting

"PRIMARY TRAINER"



Plans for building the primary trainer

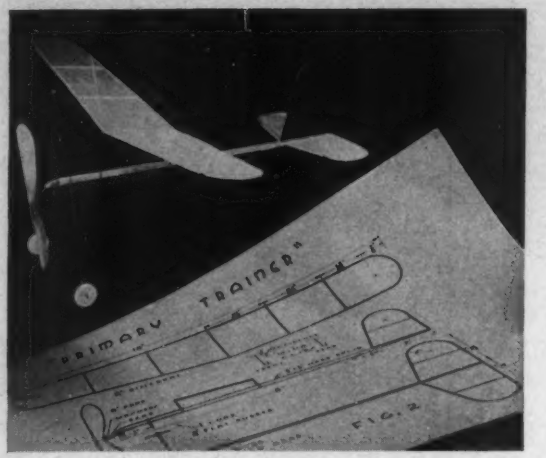
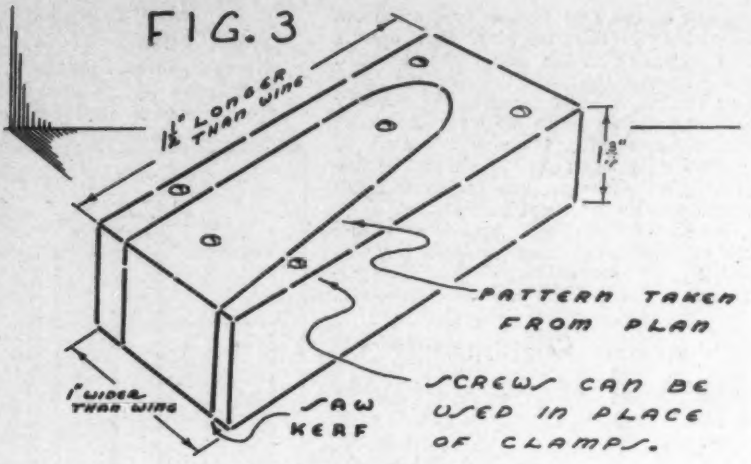


Fig. 1. The primary trainer



Form for bending wing tips

of miniature aircraft; secondly, to develop pupil interest in aviation; and third, to study its impact on society. The beginning models must be characterized by simple construction and good aerodynamic design to achieve these objectives.

The wing construction illustrated in this article, being quite simple, allows a maximum of time and effort to be spent on flying and adjusting models. It is designed to achieve the objectives of the *air-age* program. The beginner can use ready formed wing tips to shorten the construction time as well as to assure success. The production of the wing tips may be accomplished by mass production before the class begins. A few advanced students can manufacture a year's supply of wing tips in two or three class periods.

The process of forming the balsa for wing tips could be used to achieve other educational ends, if it were demonstrated to the whole class and compared to similar processes used in glider construction. This would give the student an understanding of the complete process even though he might participate in only a part.

The elevator and rudder can be built with similar construction to further simplify the model.

The purpose of this article is to suggest a type of wing construction and not to give detailed instructions for making any particular type of model. Plans for a model have been included only to illustrate how the wing and tail can be used, but it should be clearly understood that this type of wing construction can be used on almost any model. Figure 6 shows how it can be adapted to many types of models. The value of this type of wing can best be shown by an explanation of the processes of construction and the possibilities for variation.

Construction

The processes of construction can be separated into two divisions, those that should be finished before the class begins and those in which the class will participate. The forms can probably best be cut by the teacher or an advanced student. This is the only part that requires any amount of skill. A very inexperienced student can carry on the process from here. Clamping the tips in the forms and stripping the pieces in the balsa stripper are relatively easy. When the tips are distributed to the students, the construction will move rapidly allowing much more time for flying and adjusting the models as well as experimenting with many aerodynamic designs.

Forms. A device for holding the balsa sheets to the correct shape during the drying operation is necessary. A form can be made from white pine, Figure 3, by cutting the wing shape with a band or jig saw. The width of the saw kerf is sufficient to allow space for the balsa sheet. It is advisable to make several forms so the wing spars can be made by mass production.

Bending the Spars. Select a strip of balsa that is at least two inches longer than the perimeter of the wing. This allowance makes it much easier to handle the hot balsa strip during the forming process. Soak the strip of sheet balsa in hot water. Bend it around the form, and clamp the form, as shown in Figure 4. Allow the wood to remain in the form until dry. It is possible to put two sheets of 1/32-in. balsa in one form but the drying time is thereby increased. Mark the trim line on the balsa at the end of the form before removing. All strips can then be cut to the correct length.

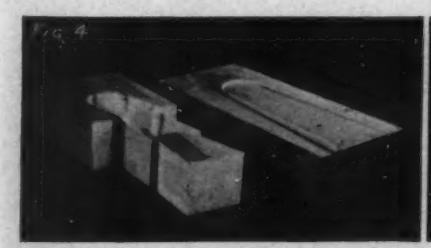
Stripping the Balsa. The spars can be cut from the balsa sheet with a balsa stripper shown in Figure 5. It is necessary to replace the usual hold-down guide with two pins driven on each side of the blade for cutting around the curves. Several strips can be cut at once by assembling several razor blades spaced with washers on the balsa stripper.

Building the Wing and Tail Surfaces. The teacher now can furnish his classes with wing spars and tail parts ready formed. Even the most inexperienced can build a successful flying model with these parts. Glue the spars together with ribs in place on the plan. Cover with tissue. Remove the wing from the plan. Break the joint at the center, raise one side of the wing to produce the desired dihedral angle and glue the joint. Fasten wing clips to the wing. The tail surfaces should be cemented to the tail boom before covering.

Motor Stick. Several types of motor stick construction are possible. The one shown in Figure 2 is quite simple. Glue the fittings in position on the motor stick, make a landing gear of wire or balsa and fasten it in position.

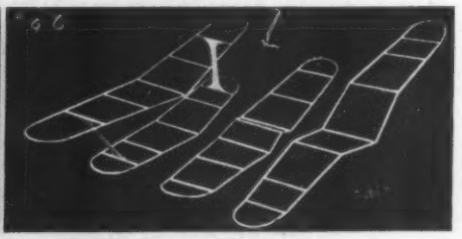
Propeller. Machine cut propellers are simplest for beginners to shape. It is also possible to purchase small finished propellers at reasonable prices. Many good descriptions of propeller carving are available in model airplane books.

Experimental Possibilities. The wing construction described has many possibilities to challenge the more experienced builder. Figure 6 shows some of the types of wings that are



Wing and tail forms in use

Cutting with balsa stripper



Additional possibilities of wing construction

possible by this process. Gull type wings can be made by breaking the wings after covering and cementing at the new bends. Inverted gull wings give the model the appearance of a dive bomber. A biplane wing can be made by fastening a small wing beneath the larger with struts. Cambered wings may be made by cementing cambered ribs in position. The substitution of airfoil sections for straight ribs makes possible the use of airfoil wings.

Air-conditioning youth through experience and experimentation can be facilitated by simplifying the construction procedure. The purpose of this article is to help achieve this aim.

ARROW PAINTING RIG

ALLEN A. GLISCH

Milwaukee, Wis.

A handy device for archery students is this easily made arrow painting rig used to paint the crest on arrows. Constructed by Roy Earhart of the Milwaukee public schools industrial-arts department this efficient rig is built on an old spring-wound phonograph which can

Archery painting rig

be purchased from a second-hand supply shop at a nominal cost. A small metal tube is sweated onto the spindle used to hold the record on the turntable. The arrow is held firmly in the tube by a small pin placed there by drilling a small hole in the tube and inserting a nail. The nock of the arrow will fit snugly into the pin and will not permit the arrow to slip while painting. Various speeds can be obtained by the same lever used to increase the tempo of the record. Paintbrush supports can be built to fulfill your particular requirements.

PENCIL POINTER

HOMER C. ROSE

Armored Force School

Fort Knox, Ky.

The illustration shows a novel way of pointing drawing-pencil lead. The device consists of a cup-shaped piece of wood, the internal surface of which is covered with fine sandpaper.

This little gadget has proved its worth since 1932 in the author's classrooms. It is cleaner, faster, and easier to use than the traditional sandpaper block.

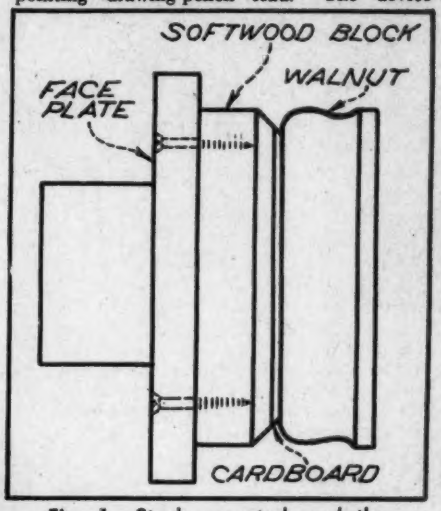


Fig. 1. Stock mounted on lathe

How to Make a Pencil Pointer

Saw a piece of ¾-in. walnut or other hardwood to 2¾ in. diameter, and saw another block of softwood to the same or to a slightly larger diameter. Center this last piece and mount it on the faceplate of the lathe.

Fig. 4. The pencil pointer in use

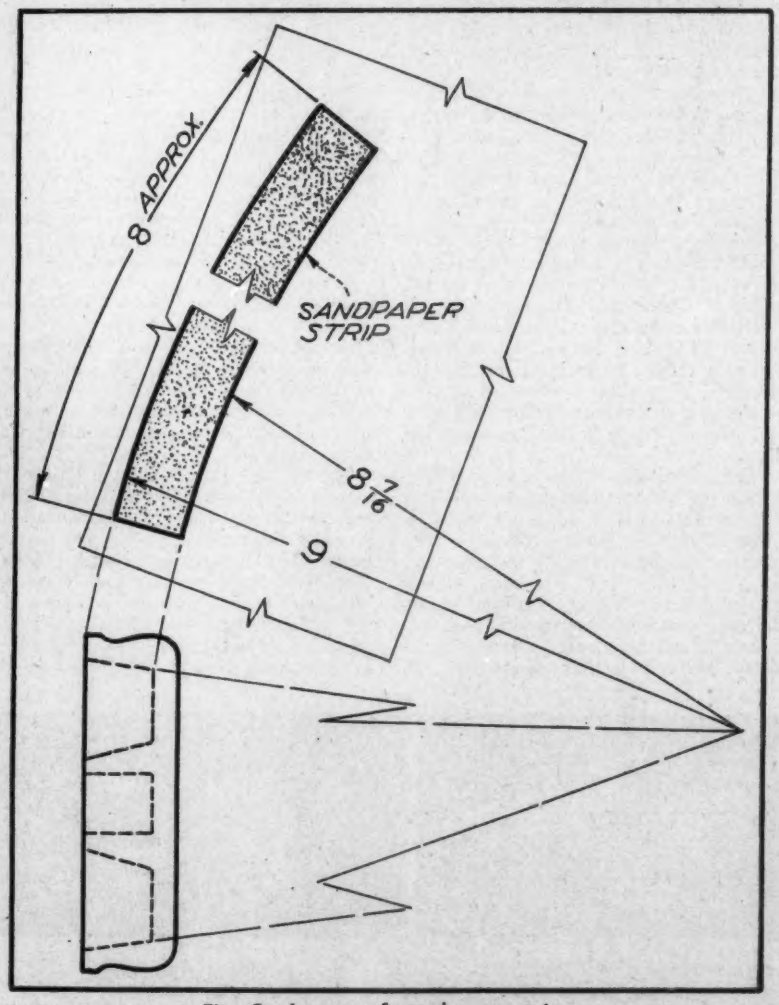


Fig. 3. Layout of sandpaper strip

Glue the hardwood block to the softwood block, with a disk of cardboard between them, as shown in Figure 1. When the glue has set, turn the hardwood piece to the size and shape shown in Figure 2.

Split the cardboard with a wide chisel, and sand the back of the pointer.

Make a layout of sandpaper strip as shown in Figure 3, and fit it into the cup. Cut it to exact length and glue it in place.

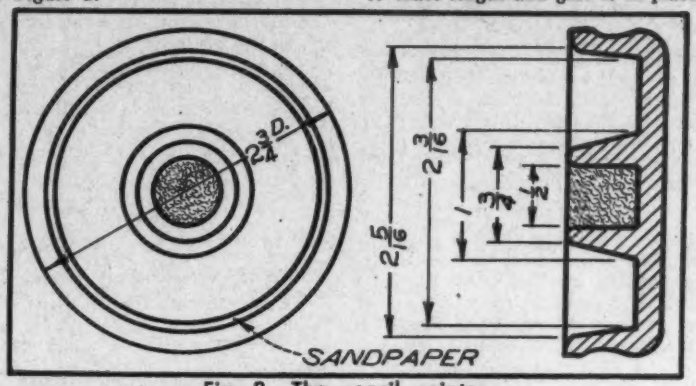


Fig. 2. The pencil pointer

Shellac the wood, put a tuft of cotton in the center hole, and your pointer is ready for use.

To point a pencil, hold it loosely in the finger tips of the right hand, and hold the pointer facing it. Twirl the pencil around the inside of the cup, using an arm swing rather than a wrist motion. The abrasive cuts the lead down to a nearly perfect cone with the proper taper.

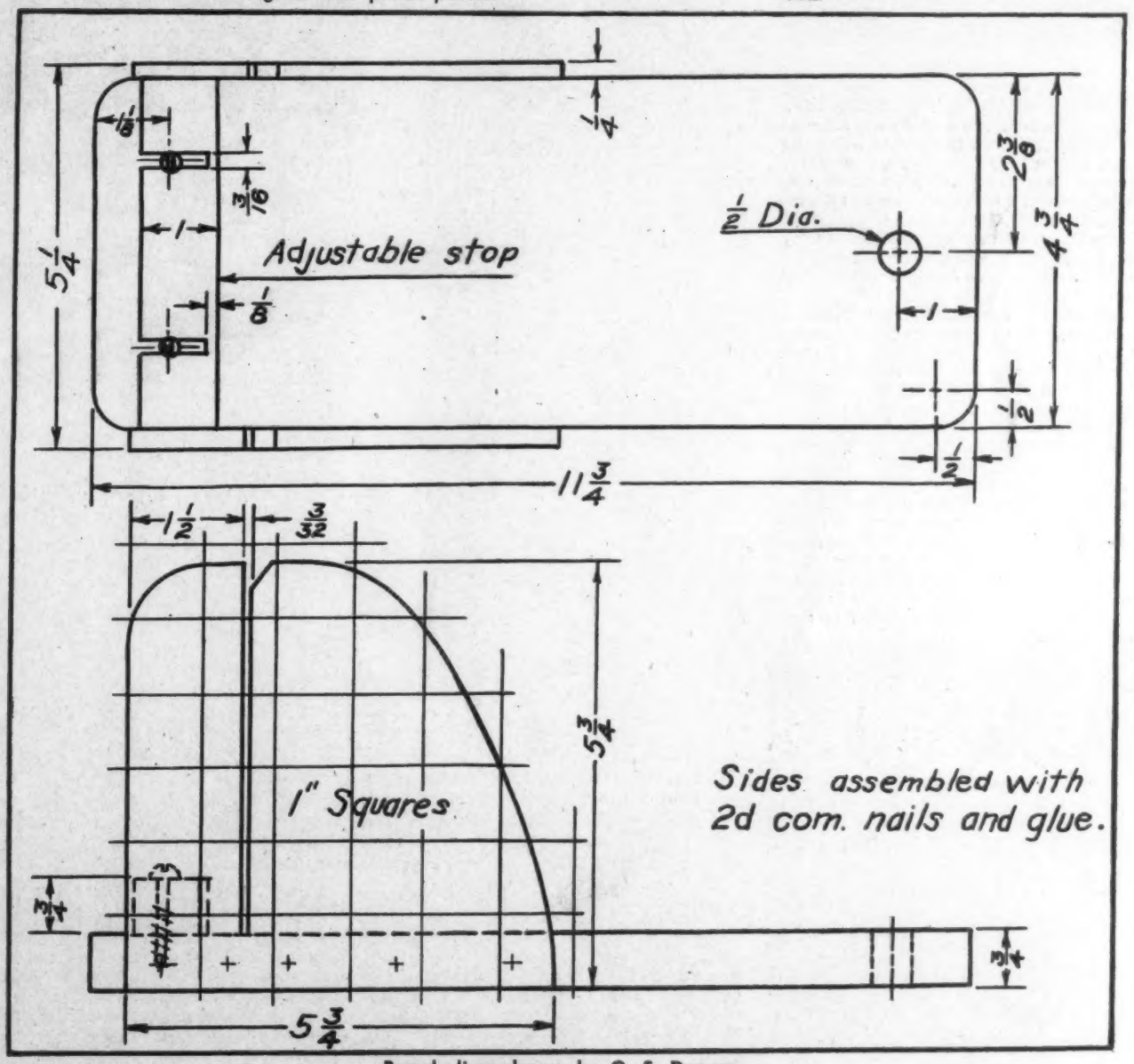
A BREAD-SLICING JIG*

G. S. DUNCAN

University Laboratory School
University of Missouri
Columbia, Mo.

When the bakers ceased slicing bread and mother found difficulty in keeping the slices regular in thickness and shape, this bread-

*A good project even if the bakers are again slicing the bread.



Bread slicer drawn by G. S. Duncan

The bread slicer in use

slicing jig was developed. Consisting of a rectangular bottom, two slotted panel sides assembled with nails and glue and an adjustable stop to control the thickness of the slices, the total cost does not exceed ten cents. It is so simple in design and construction that fourth graders can turn it out in two class periods. Its popularity has been an epidemic — every boy's mother has wanted one, her friends have placed their orders, and even a store has asked if it can be supplied.

Any common size loaf will fit this slicer. Bread is best sliced by placing the loaf in the jig with the top of the loaf toward oneself. The bread is held gently against the stop and a side with one hand while the other operates the bread knife which is lowered in the slots and used with a gentle sawing motion. The adjustable stop can be set for slices ranging from ⅛ to ¾ in. in thickness.

The finish may range from no finish at all to an artistic enamel job. A quick and attractive finish consists of single coats of shellac and wax. A small transfer may be placed on the sides.

This project has proved itself, meeting a timely utility demand in the home; it is simple, inexpensive, and lends itself to creativeness in design and finish.

THE ABRASIVE TOOLS OF INDUSTRY — PART I

J. E. DONALD HASTIE

Niagara Falls, N. Y.

(*Continued from page 173 of the April, 1943, issue*)

The commercial grain sizes are as follows:

Coarse range		*Medium range*		*Fine range*		
6	14	30	60	120	280	or F
8	16	36	70	150	320	or FF
10	20	40	80	180	400	
12	24	50	90	220	500	or FFF
			100	240	600	

The Bonding Materials

There are five basic bonding materials used as a *binder* in the manufacture of grinding wheels. The purpose of the bonding material is to hold in place the grain particles which actually do the job of cutting.

These five basic bonding materials are:

1. Clays or glasses (vitrified products).
2. Silicate of soda (silicate products).
3. Resinoid (synthetic resin products).
4. Rubber (vulcanite or vulcanized products).
5. Shellac (elastic products).

Any one of these bonds may be used with the two manufactured abrasives, silicon carbide (SiC) or aluminum oxide (Al_2O_3), in practically the entire range of grit or grain sizes.

The Grade

The grade of a grinding wheel is generally considered as the degree of strength with which the bonding material holds abrasive grain or grit particles in the form of a wheel. It is also a measure of resistance offered by the composite strength of bonding material and grain particles to the grinding stresses which operate to tear the grain particles out of the wheel face and wear away the wheel.

Depending upon the degree of tenacity, grinding wheels are broadly classified as hard, medium, or soft. There are many variations of grade in a grinding wheel running from very hard to very soft.

The Structure

Structure is basically the relationship of abrasive grain to bonding material and to the spaces or voids that separate them. The degree or extent of spaces or voids in a grinding wheel is sometimes called porosity. All grinding wheels are porous to a greater or less degree, depending on the size of pore spaces or voids purposely built in between the bond and the grain. In Figure 12, the shaded areas represent the abrasive grain; the heavy black lines, the bond "posts"; and the white spaces, the voids.

The structure of a grinding wheel can be precisely controlled from a very dense to a very open wheel.

What a Grinding Wheel Does

We now discuss the functions of abrasive grain, bond, grade, and structure in relationship to what a grinding wheel actually does.

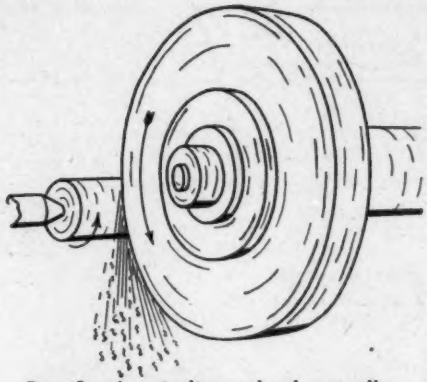


Fig. 8. A grinding wheel actually cuts away chips from the piece being ground

Fig. 9. Photomicrograph of metal chips produced by a grinding wheel which is cutting correctly

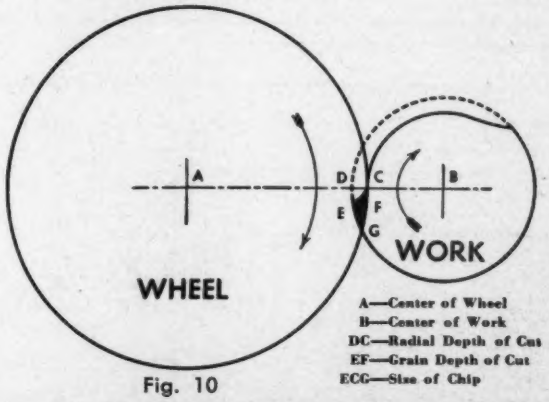


Fig. 10

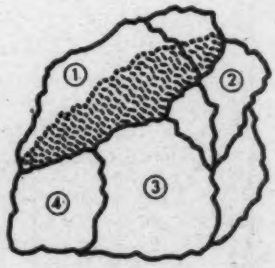


Fig. 11

Fig. 10. The abrasive grain cuts into the work until it becomes dull, then it breaks down (fractures) and exposes new cutting crystals with sharp edges to the work. Fig. 11. Sketch of typical abrasive grain particle showing probable cleavage lines forming new crystal cutting edges

Function of Abrasive Grain

Grinding wheels are essentially disks of various thicknesses containing thousands of abrasive grain particles, each one of which is actually a sharp cutting tool. They do the job of cutting away the surface of the material being ground.

Essentially, the abrasive grain cuts away small pieces of the work. These small pieces are commonly referred to as *chips* and their presence is evidence that the modern grinding wheel cuts in a manner similar to a multi-point cutting tool.

For example, a grinding wheel of closely spaced grain composed of grain in 50-grit size, with a 2-in. face, and revolving at a speed of 5000 surface feet per minute (s.f.p.m.) will bring to bear against the work being ground approximately 300,000,000 abrasive cutting points during every minute of operation. (This is a hypothetical situation assuming that the grain is so closely packed that there are 50 cutting points per lineal inch on the surface of the wheel.) With this statement still in mind, it can be easily understood that the chips which are cut away from the work must each be very small.

However, the size of the chip is subject to control by introducing into the grinding wheel at time of manufacture one of the many available grit sizes. These grit sizes range from very coarse grits to very fine ones.

Generally speaking, coarse grit sizes will cut away bigger chips and as a result leave a rougher surface on the work being ground. Fine grit sizes cut away smaller chips and thus leave a smoother surface.

Figure 9 shows how the abrasive grain particles in a grinding wheel actually cut chips out of the work being ground.

However, it is evident that the breakdown or fracturing procedure of individual grain particles comes to an end when each abrasive grain has been worn out and can no longer function as a cutting tool. Theoretically, when this point is reached, grain particles are pulled out or forced out of the grinding wheel face by pressures generated in the grinding operation. And as this happens, new, sharp abrasive grain particles are immediately exposed to continue the cutting or grinding action.

Under the conditions described, the question then arises as to what holds the abrasive grain or grit in place within the wheel face and releases it when it is no longer capable of cutting efficiently.

Function of Bond

Bond is the material in a grinding wheel that holds the abrasive grain particles in the form of a wheel. In other words, the bond material is simply a tool post which holds the cutting tools (abrasive grains) in place while they do their work.

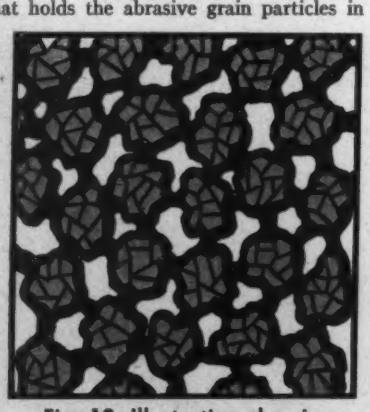


Fig. 12. Illustration showing bond "posts" holding abrasive grain particles. (Heavy black outlines represent bond "posts")

When individual grain particles become dull or break down completely, the bond material releases the dull abrasive grain and thus exposes new, sharp abrasive grain particles to continue the work.

Naturally, when the grain particle breaks down or becomes dull, normal grinding pressures increase to the point where the bond *post* is not able to hold the grain particle in place. At that point the bond post automatically breaks away, releases the dull abrasive grain, and presents a new set of sharp cutting tools to the work.

Five Bond Types

As pointed out previously, there are five principal bond types. A description of what they are and their major characteristics follows:

Vitrified bond is used for over 75 per cent of the grinding wheels manufactured. Porosity and strength of wheels made with this bond give high stock removal. This bond is not affected by water, acid, oils, or ordinary temperature conditions.

Silicate bonds wheels release the abrasive grains more readily than vitrified bond wheels. They are used for grinding edged tools and where heat generated in grinding must be kept at a minimum.

Shellac bond is capable of producing high finishes on camshafts and mill rolls, etc. It is cool cutting on hardened tool steels and thin sections.

Resinoid bond is a synthetic organic compound and resinoid bonded wheels can be made in various structures from hard, dense, coarse wheels to soft, open, fine wheels. They cut cool, remove stock rapidly, and can be run at high speeds.

Rubber bond is used chiefly where a good finish is required. Because of its strength and toughness, this bond is extensively used in making extremely thin wheels.

To summarize, then, the purpose of bond, of which there are five types, is to hold abrasive grains or grits in place in the form of a wheel. This is accomplished by bond *posts* which, like a tool post holding a cutting tool, grip each individual grain particle until it has performed its cutting job efficiently and completely.

Function of Grade

The grade of a grinding wheel is generally considered as the measure of "holding power" or the degree of strength with which the bond posts hold the abrasive grains or grits in place within the wheel. It is also the measure of resistance offered by the composite strength of bond posts and abrasive grain particles to the grinding stresses which operate to tear the grain particles out of the wheel face, break down the bond posts, and thus wear away the wheel.

Depending upon the type of bond, it is the amount of bond material which determines the degree of *hardness* or *softness* of a grinding wheel.

When the amount of bond is increased the size of the bond posts linking grain particles together is enlarged. Naturally, the larger the bond post is the stronger it is. And the measure of this strength is indicated by wheel grade symbols which run all the way from an *extra hard* wheel to a *very soft* wheel.

VITRIFIED & SILICATE WHEELS		SHELLAC, RESINOID & RUBBER WHEELS
Extra Hard		1
F	H	2
G	A	3
Hard	R	4
I	D	5
J		6
K		7
L	T	8
Medium	O	9
N		10
O		11
P	S	12
R	O	13
Soft	F	14
T	T	15
U		16
Very Soft		17

Fig. 13. Wheel grade symbol

Later on, the selection of correct wheel grade for specific grinding jobs will be discussed. For the time being, let us say that there are a variety of grinding operations which may require either a wheel of hard grade or a wheel of soft grade.

Most grinding wheel manufacturers provide wheels in a complete range of grades and the selection of the correct wheel grade is determined by the requirements of each grinding job.

(To be continued)

BOOK ENDS

DELMAR W. OLSON and WALTER TROUTMAN

Southern Illinois Normal University

Carbondale, Ill.

The project described herewith will appeal to the homecraftsmen and to the teachers who find that rising materials prices are affecting their materials budgets. The project is small enough that it doesn't require much material and it is so adaptable that any of a variety of materials may be used.

The book ends shown in Figure 1 are made of plastics, while those pictured in Figure 2 are of hard maple wood. Various kinds of woods, metals, leather, linoleum, cork, wall-

Fig. 2. Book end made of maple

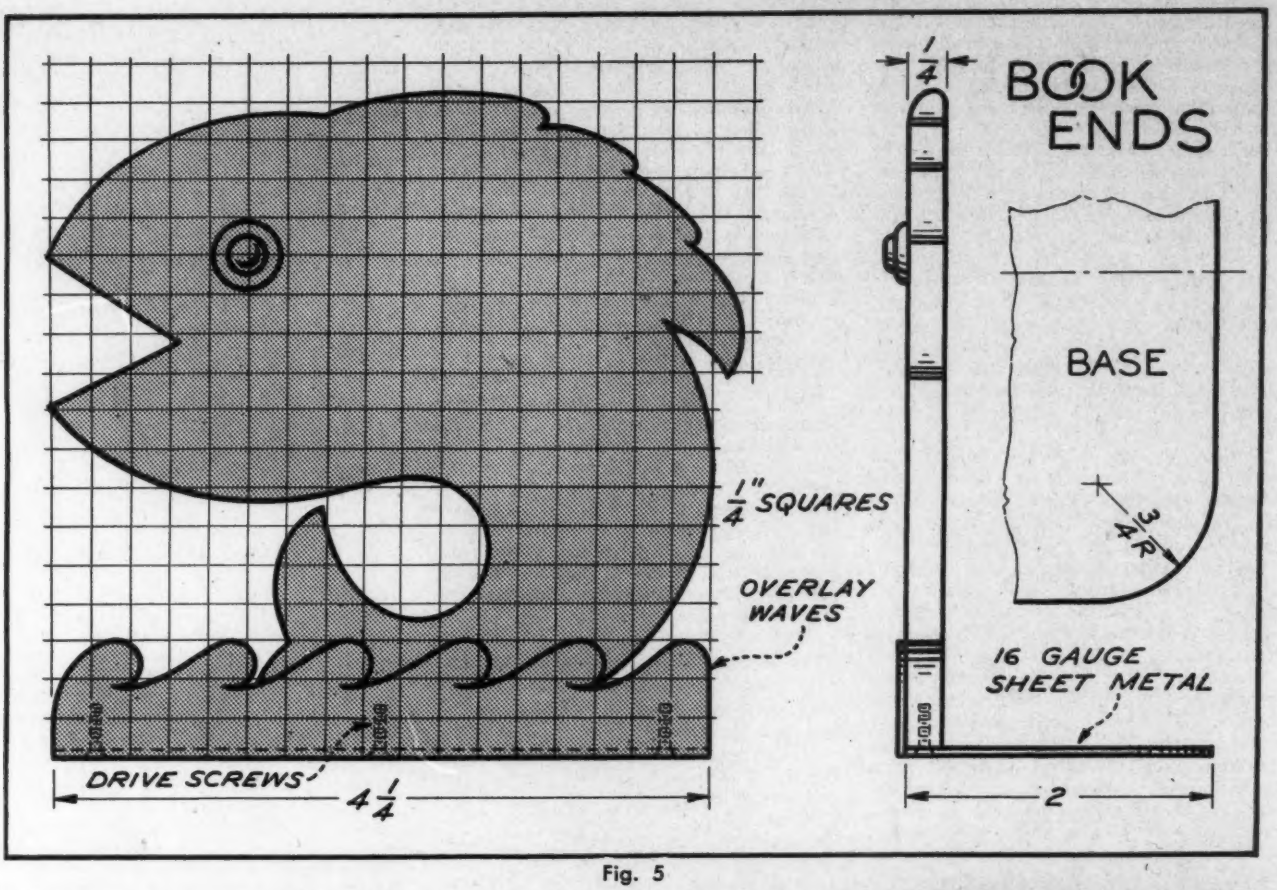


Fig. 5

board, and imitation marble could be used with pleasing results.

Whatever the materials used, the method of procedure is basically the same, involving the preparation of patterns, selection of color schemes, sawing, smoothing, assembling, and finishing. The method of making the eyes will vary with the material used. Those of plastic were shaped with a file on a polishing head as shown in Figure 3. The little button of plastic was cemented to a piece of dowel rod with stick shellac. The rod was inserted in the chuck and the eye shaped while turning at a moderate speed. The black pupil was cemented to the button with the adhesive recommended by the maker of the plastics.

Rough surfaces were smoothed first with fine files and then with waterproof 6/0 and 8/0 polishing paper under water. A buffing wheel and polishing compound were used to get the high luster.

The metal bases were made of 16-gauge aluminum salvaged from an old radio chassis. They were fastened to the plastic fish with drive screws. Pilot holes, slightly smaller than the screw shank, were drilled into the plastic. This was heated in hot water and the screws driven in for a shrink fit.

Fig. 3. Dressing the eyes to shape on a polishing head

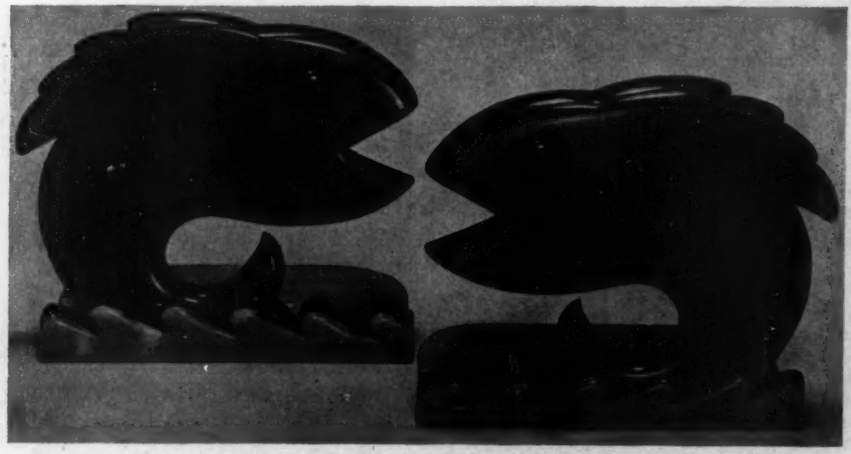


Fig. 1. Book ends made of plastics

Fig. 4. Wood chuck for ripping plastic waves

The other book ends were made of 1-in. hard maple, with black walnut waves glued on. The metal bases were fastened on with flathead screws. The eyes were black upholstery nails. For a finish, the book ends were dipped in hot paraffin. When rubbed down this gave a soft gloss without darkening the color of the hard maple.

Figure 5 gives the required details for this type of book end.

FISHERMAN'S BAIT BOX

NORMAN W. MORGAN and
WILLIAM B. EVANS

Technical High School
Scranton, Pa.

1. Cut maple block 1⅞ in. thick and same shape as layout, less the thickness of the metal used in the construction.
2. Cut out top and bottom and turn 3/16 in. on turning machine.
3. Place on template and tap with tinner's mallets or hammer to get proper angle.
4. Cut piece for side and form on slip forming machine.
5. Shape on maple block and solder seam. Solder bottom to side.
6. Solder hinges to top and side.
7. Directly under hinges solder belt loops.
8. Air holes in top may be made in the shape of the maker's monogram.

TWO-TONE FINISH ON OAK

LOUIS F. BAROCCI

High School
Cudahy, Wis.

The Job: To apply a two-tone finish on oak wood. Oak wood being open grained, it lends itself very well to this type of finish. This finish is quite extensively used on kitchen and some bedroom furniture.

Materials: White paint or white lead, yellow coloring pigment (light chrome yellow), turpentine, drier, dark paste wood filler, shellac, lacquer, lacquer reducer, burlap, No. 280–A or No. 360–A wet or dry paper, and furniture polish. Varnish may be used in place of lacquer.

Tools and Equipment: Putty knife, paintbrush, shellac brush, filler brush, container for mixing primer coat, rubbing block, spray gun, lacquer or varnish.

Procedure:

1. Prepare surface. All tool marks must be removed. Ease all the arrises.
2. Sponge with water, let dry.
3. Sand lightly, then dust.
4. Prepare priming coat.

a) Use equal parts of white lead and oil. Add turpentine and coloring pigment and mix well. (Caution: apply pigments in small portions or you may have too much color in the primer.) This primer should be of a very thin consistency. When you have the "blond" tinge desired, it is ready for application.

5. Apply the priming coat:

a) Apply with paintbrush, brushing in direction of the grain. Do not wipe. Allow to dry 24 hours.

6. Apply wash coat of shellac ½-lb. cut. Let dry.
7. Apply dark or light filler, depending upon the kind of finish that is desired.

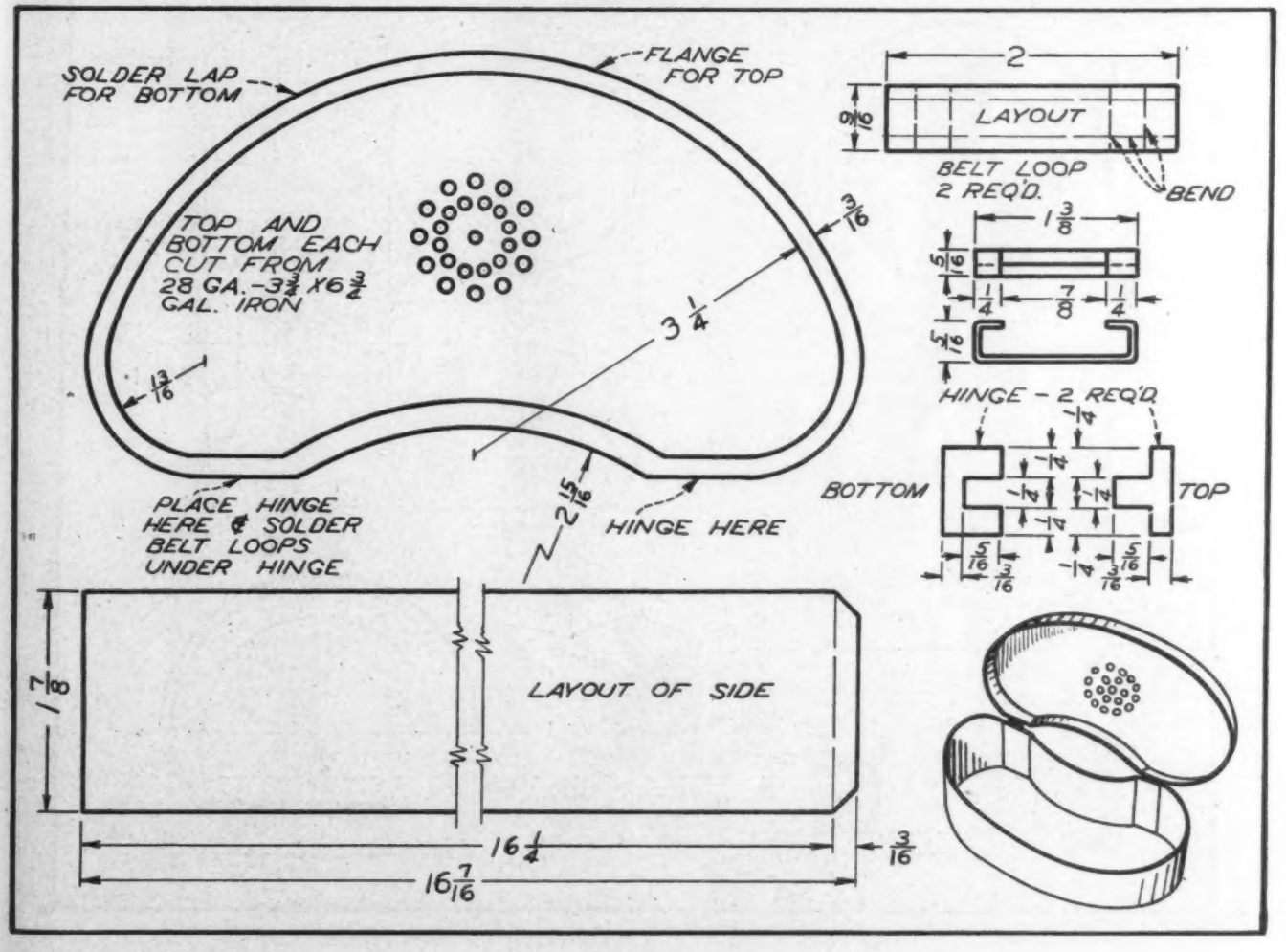
a) Apply filler, being careful to work filler in the open grain of the wood.

b) Wipe off surplus across the grain, using burlap.

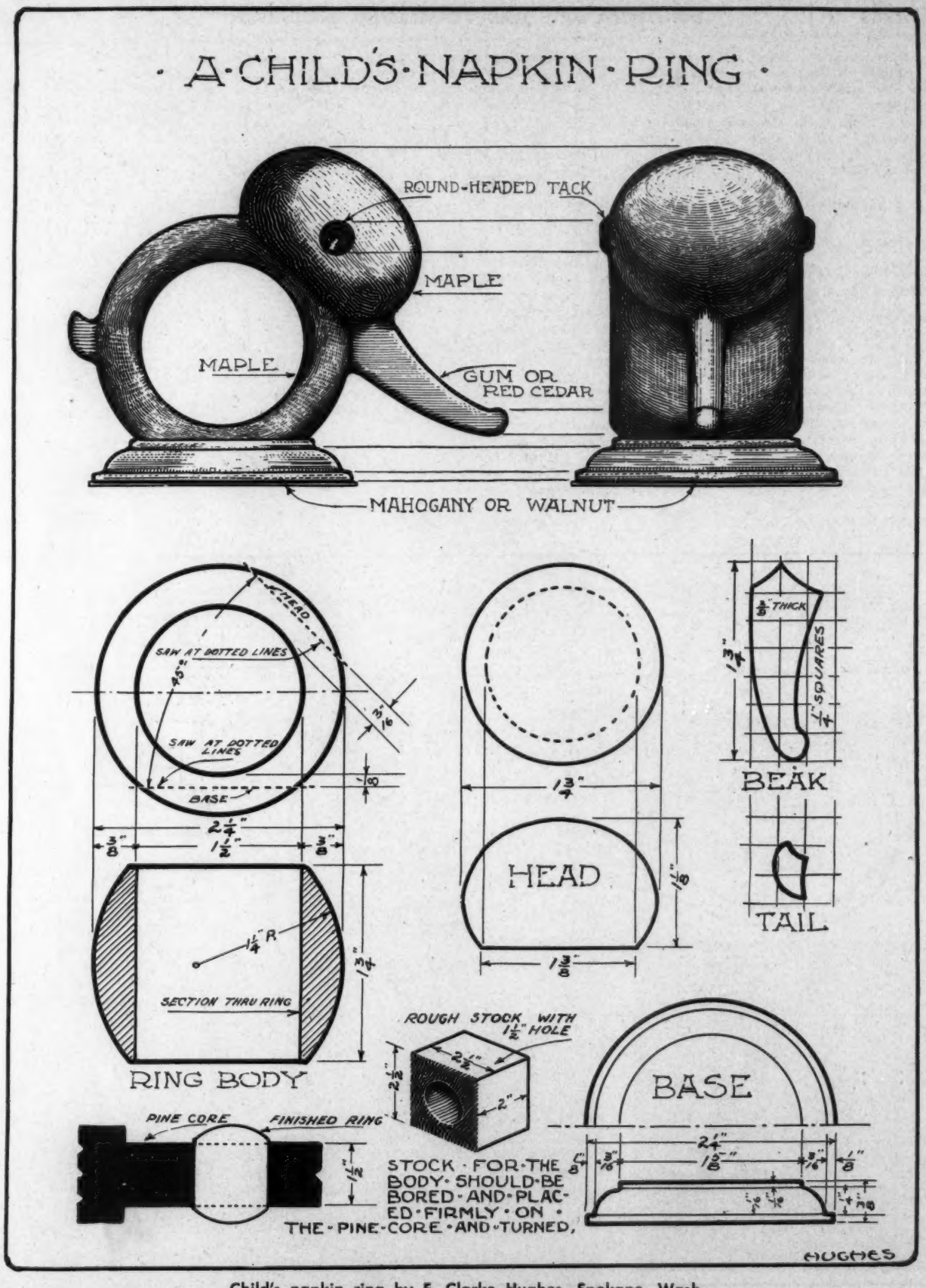
c) Take light stroke with grain to remove cross marks.

8. Apply shellac 2-lb. cut. Let dry 12 hours.
9. Sand lightly, using steel wool No. 1/0 or No. 360–A wet or dry sandpaper.

(Continued on page 20A)



Bait box



Child's napkin ring by F. Clarke Hughes, Spokane, Wash.
(For description see page 20A)

IN WHAT WAYS IS CAST METAL USED?

1. For producing duplicate parts. Castings may be made in molds of sand, plaster, metal, cuttlefish bone, or stone. Exact duplicates are possible in any desired numbers.

Side Plate of Cast Iron Six-Plate Stove Cast at the Mary Ann Furnace (from The Bible in Iron, by Dr. Henry Mercer). Probably poured in an open sand drag.

Pewter Spoon Cast in Bronze Mold (Mold the property of the Ohio State Historical Museum)

2. For objects requiring weight.

Brass Door Stop after Traditional Hessian Andirons, an Eighteenth Century American Design

3. For objects impracticable of production by other means.

Brass Candlestick Cast in Several Parts with Sand Cores to Produce a Hollow and Therefore Lighter Article

Plate 18. Design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

CAST METAL, Continued

The casting technique frequently is useful for producing accessory parts, such as knobs, finials, feet, or handles.

Brass Jamb Hook for Fire Tools with Cast Brass Finials (Ball and Ball)

Brass Dog's Foot for Duncan Phyfe Table (I. Sack)

Two Late Seventeenth Century Furniture Drop Pulls

Pewter Porringer with Handle Cast by H.J. Kauffman, after an Original by Boardman

Casting in Cameo Relief

Paper Knife (from "Pewter in the Netherlands")

Casting in Full Relief

Pipe Stand of Pewter (from "Pewter in the Netherlands")

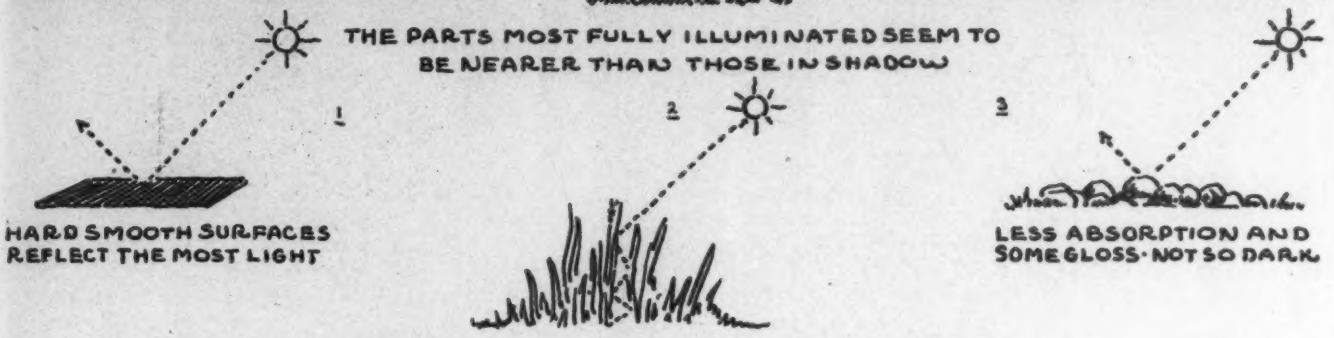
Plate 19. Continuation of design course by Burl N. Osburn, director of industrial arts, State Teachers College, Millersville, Pa.

Camouflage..

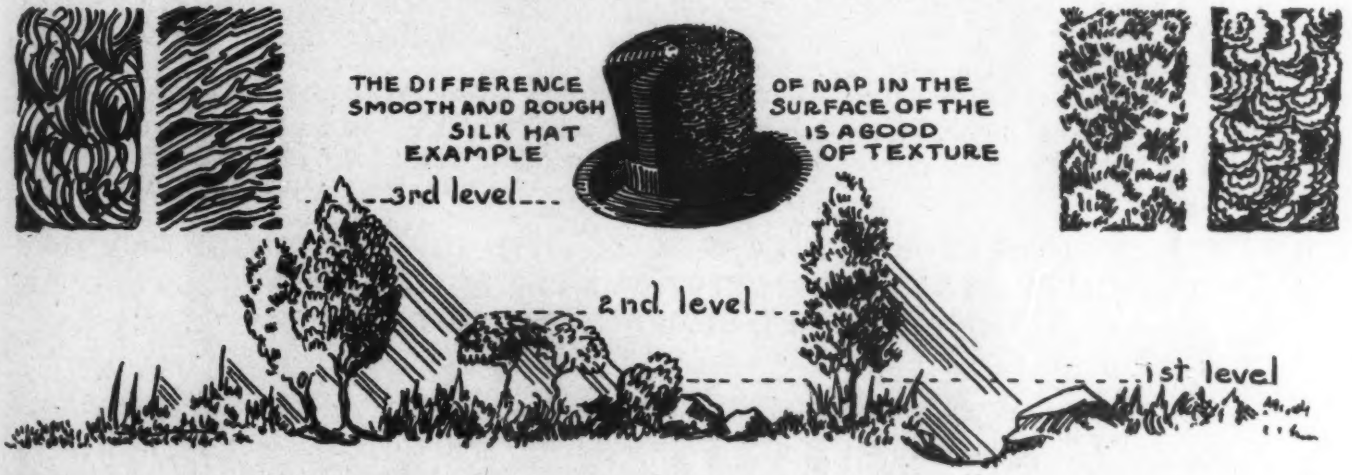
TEXTURE AND RELIEF IN NEED FOR BOLDNESS OF EFFECT

Texture..

CAMOUFLAGE, BECAUSE OF A ARE CLOSELY ALLIED


THE PARTS MOST FULLY ILLUMINATED SEEM TO BE NEARER THAN THOSE IN SHADOW
1
2
3
HARD SMOOTH SURFACES REFLECT THE MOST LIGHT
LESS ABSORPTION AND SOME GLOSS · NOT SO DARK
APPEARS DARK BECAUSE OF LIGHT ABSORPTION. LIGHT MAY EMERGE ALMOST EQUALLY AT ALL ANGLES

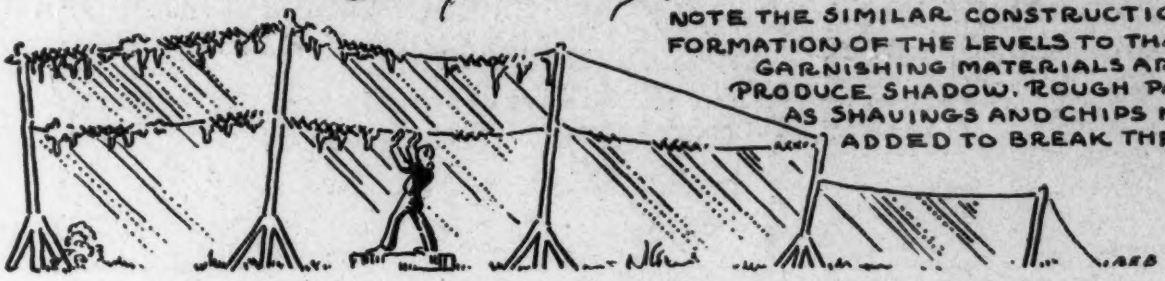
COMBINATIONS OF CAMOUFLAGE PAINTS OF THE INFRA-RED REFLECTION TYPE, OF HIGH AND LOW VISIBILITY, MAY BE USED TO CREATE THE ILLUSION OF RELIEF · COLORED PATTERNS MAY LOOK AND PHOTOGRAPH EVEN IN THE INFRA-RED FILM TO APPEAR LIKE A RESIDENTIAL AREA NO MATTER AT WHAT TIME OF DAY OR FROM WHAT ANGLE OBSERVED


THE DIFFERENCE OF NAP IN THE SMOOTH AND ROUGH SURFACE OF THE SILK HAT IS A GOOD EXAMPLE OF TEXTURE
3rd level
2nd. level
1st level

COLOR IS NOT AS IMPORTANT AS DIFFERENCES IN STRUCTURE IN AERIAL VIEWS. THE FIRST LEVEL IS RICH IN VARIETY OF TEXTURE, THE SECOND LEVEL IS FORMED OF FLOWERS, WEEDS, ETC., CASTING A SHADOW ON THE FIRST. SHRUBS AND BUSHES FORM A THIRD LEVEL IN TURN CASTING A SHADOW ON THE FIRST TWO. THE WHOLE TEXTURE IS FROM FOUR TO SIX FEET DEEP. THE CAMOUFLEUR'S STRUCTURE MUST BE SIMILARLY CONSTRUCTED.

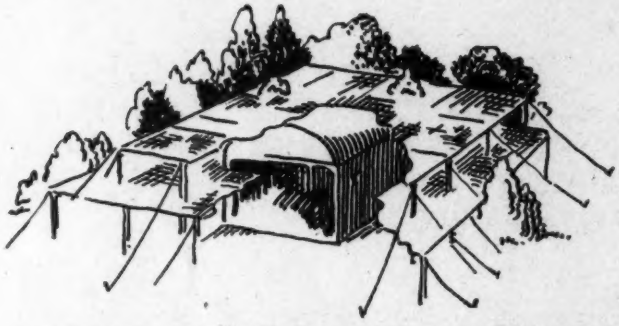
Plate 5. Continuation of camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence, R. I.

Camouflage · Texture ·

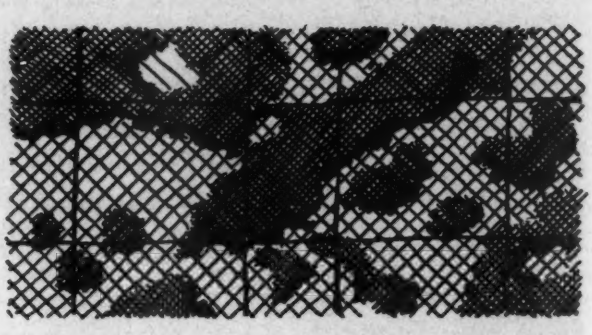


NOTE THE SIMILAR CONSTRUCTION IN THE FORMATION OF THE LEVELS TO THAT IN NATURE. GARNISHING MATERIALS ARE USED TO PRODUCE SHADOW. ROUGH PARTICLES, AS SHAVINGS AND CHIPS MAY BE ADDED TO BREAK THE SURFACE.

NETS SHOULD BE FLAT AND PARALLEL TO THE GROUND SURFACE THAT IT IS INTENDED TO IMITATE. NETS SLOPED TO THE GROUND MUST BE FLATTER THAN 8 OR 10 DEGREES IN ORDER TO ESCAPE IDENTIFICATION FROM THE AIR . . .

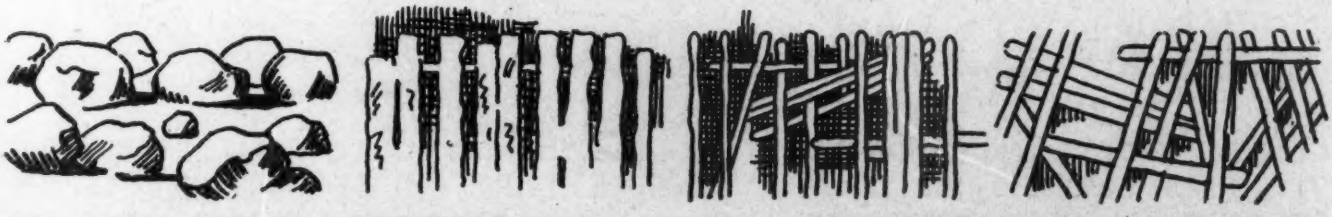


TO PREVENT DISCOVERY FROM A LOW, OBLIQUE VIEW, OVERLAPPING IS REQUIRED AND A THINNING GARNISH NEAR EDGE FOR SHADOW REDUCTION



FISHNET EASILY FOLDABLE AND PORTABLE IS GENERALLY USED FOR MOBILE SITUATIONS. METAL NET IS USED FOR LARGE PERMANENT INSTALLATIONS

COLOR APPLIED TO NETS MUST SYNCHRONIZE WITH SURROUNDINGS AND MAY BE SPRAYED ON FROM ABOVE. BRIGHTLY PAINTED BOARDS OR FABRICS MAY BE DISPLAYED BENEATH THE NET

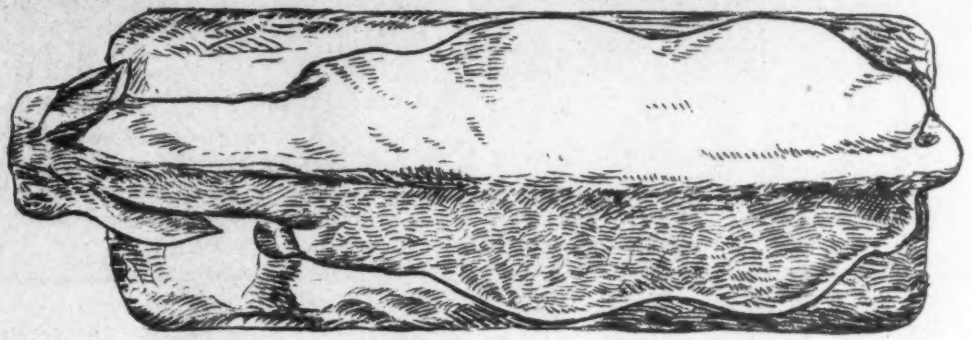


PAINT MAY NOT BE USED EFFECTIVELY TO IMITATE TEXTURE BUT RATHER A VARIETY OF MATERIALS PRODUCING TONAL VALUES. WOOD SHAVINGS, EXCELSIOR, BRUSHWOOD, POROUS CONCRETE, STRIPS OF WOOD AND ANY AVAILABLE MATERIAL PAINTED OR SPRAYED TO OBTAIN THE DESIRED EFFECT MAY BE USED.

Plate 6. Camouflage course by Richard E. Bailey, chairman, art department, Central High School, Providence R. I.

Fig. 121. Ready to be packed

Fig. 122. Fully packed



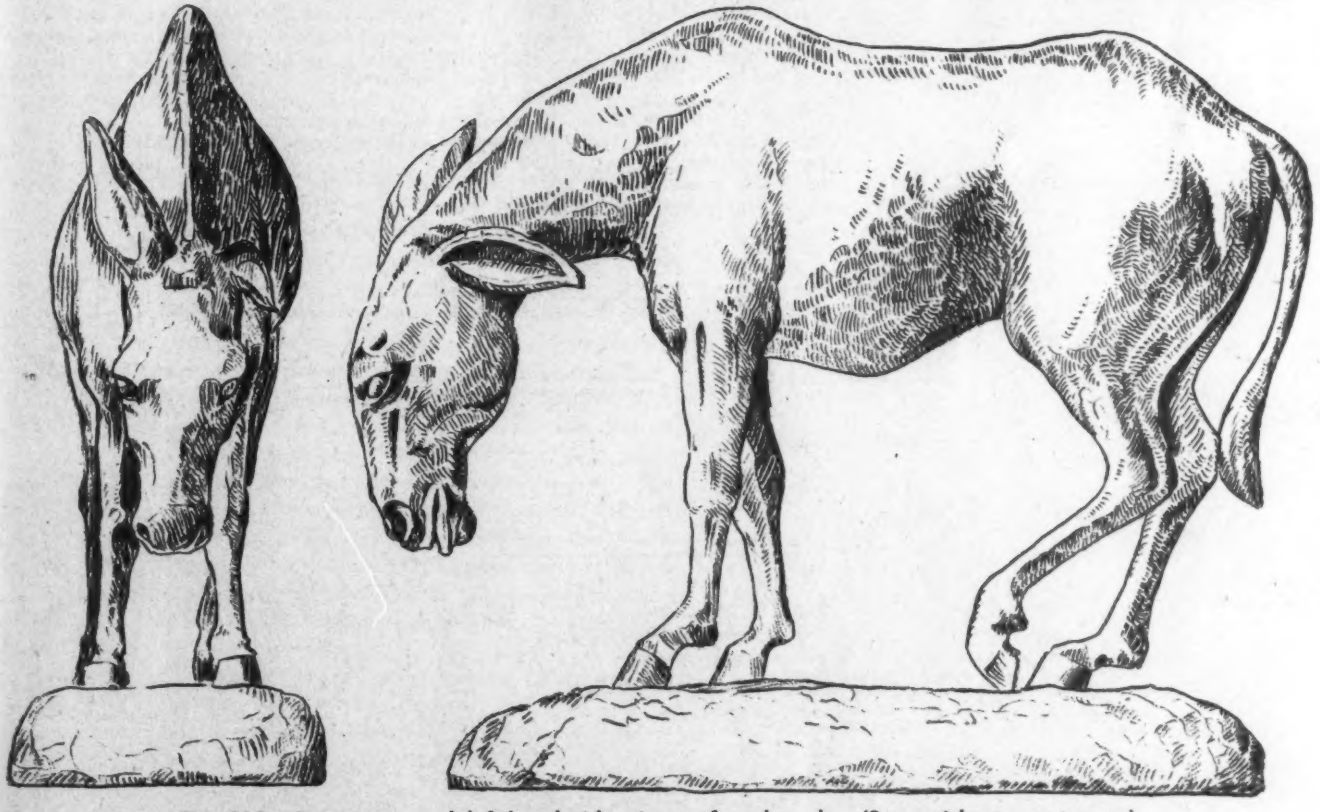


Fig. 118. Front, top, and left-hand side views of pack mule. (See article on next page)

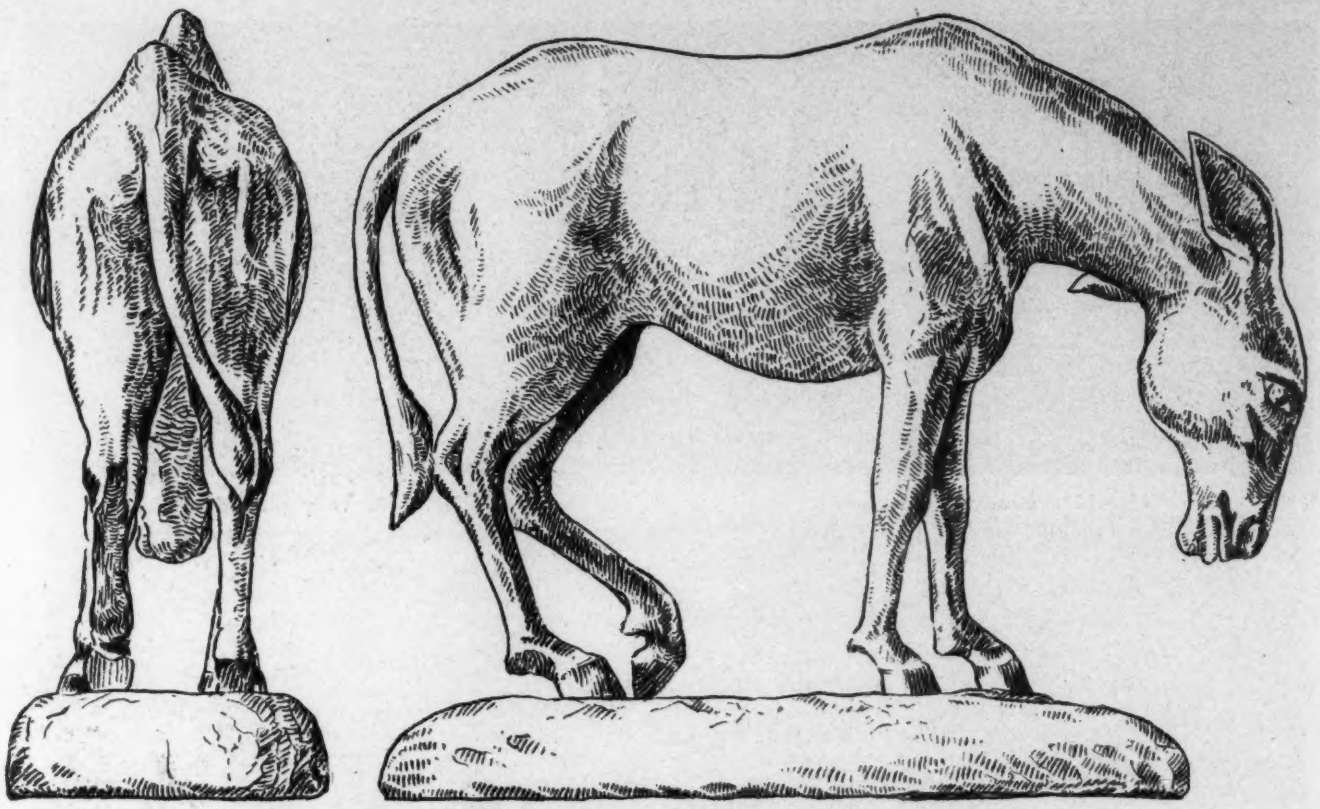


Fig. 119. Rear and right-hand views of pack mule. All patterns are full size

WHITTLING-JACKKNIFE TECHNIQUE

W. BEN. HUNT
Hales Corners, Wis.

(*Continued from page 177 of the April, 1943, issue*)

Pack Mule

Those who have followed this series of whittling projects will find the pack mule shown in Figures 118 and 119 a rather interesting job. The mule may be whittled and used as a unit, or it may be loaded with the pack as shown in Figure 122. The procedure is the same as that used for whittling the grizzly, that is, cutting out the silhouette, blocking out, and then whittling. After studying Figures 118 and 119, find a nice piece of softwood and equip yourself with a sharp pocketknife, a crooked knife, and a little patience. Then, with steady application you should have a loaded pack mule in a few evenings' time. The writer kept his pack mule in the rough rather than sanding it, and believes it looks better that way. The rugged appearance of the carving is quite in keeping with the nature of the animal and of the mining country.

The packsaddle, tools, utensils, and packs can be whittled out of scrap pieces, as shown in Figure 120. The packsaddle is made up of

(Continued on page 20A)

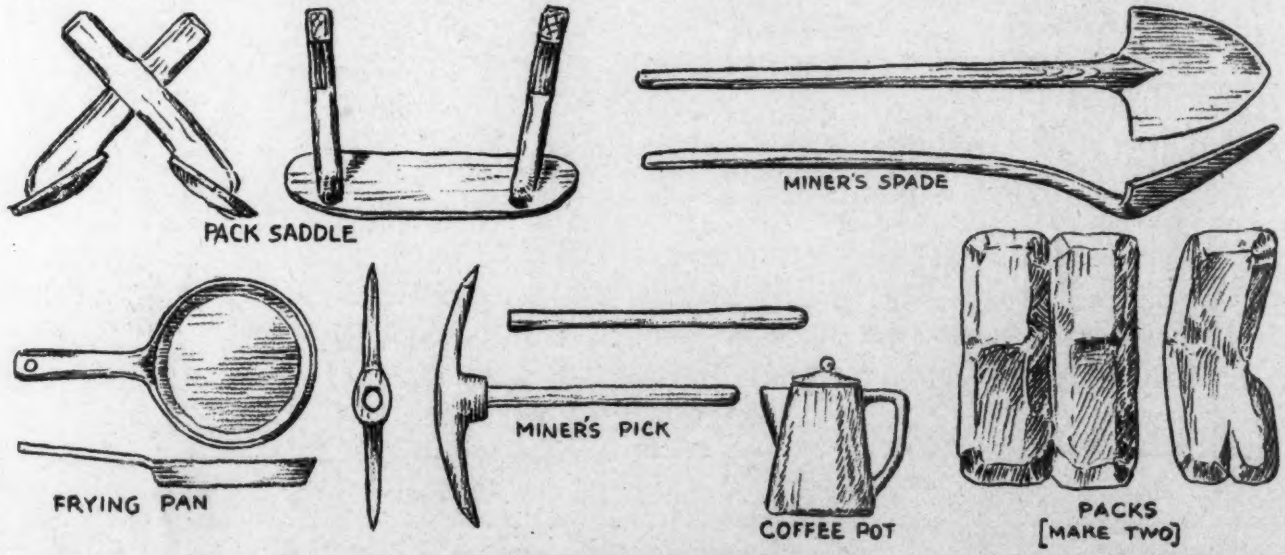
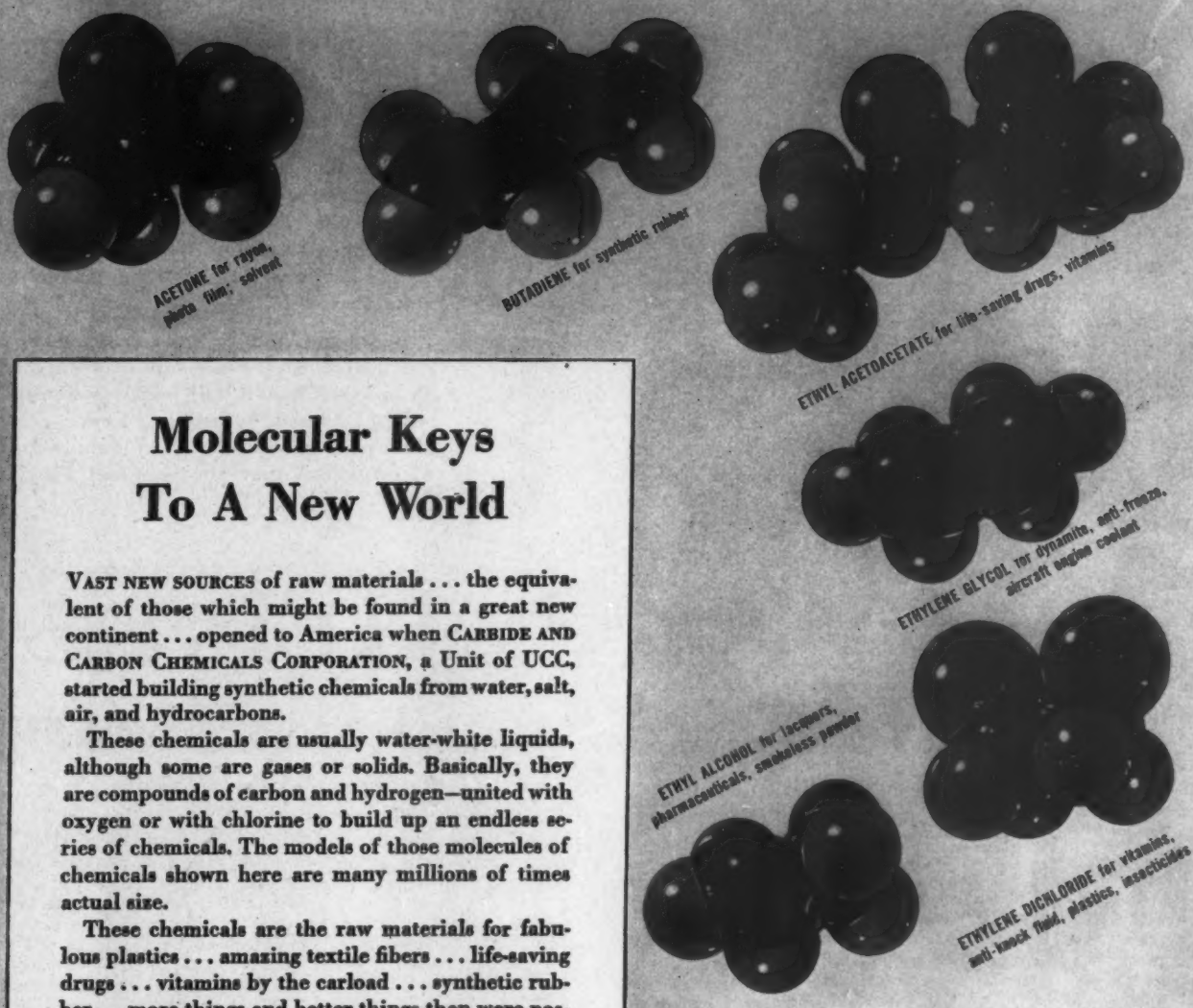


Fig. 120. Details of pack


ACETONE for rayon, photo film; solvent
BUTADIENE for synthetic rubber
ETHYL ACETOACETATE for life-saving drugs, vitamins
ETHYLENE GLYCOL for dynamite, anti-freeze, aircraft engine coolant
ETHYL ALCOHOL for lacquers, pharmaceuticals, smokeless powder
ETHYLENE DICHLORIDE for vitamins, anti-knock fluid, plastics, insecticides

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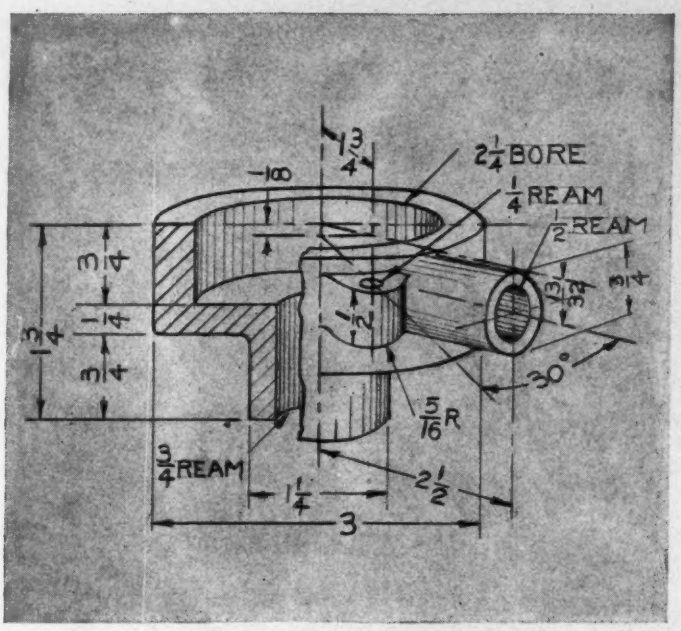
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation



PROBLEM: Ask your students to draw the correct orthographic views of this Cross Feed Ratchet Housing. *Typhonite* ELDORADO degrees recommended: 2H and 3H.

SOLUTION: We'll send you a free blueprint showing the problem's solution if you write to address at right within 30 days, specify Blueprint No. 128-J5.

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SCHOOL BUREAU, PENCIL SALES DEPT., JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.

PACK MULE

(Continued from page 222)

six pieces. The coffeepot is not hollowed out, but the frying pan is. The pickax is made of two pieces to get away from too much cross grain, and the packs are simply two pieces of wood cut to resemble bundles of blankets and a tent. The packsaddle is fastened on with two thin bands of basswood bark, using a bit of glue to fasten the ends together. The ropes are made by twisting together fibers of the inner white bark. There is a small hole drilled between the ear and the neck for the halter to go through.

Figure 122 shows how the mule is loaded. Fastening the pack onto the mule is much easier than trying to whittle the whole figure, mule and all, from one piece.

Some may even wish to load their mule with something else. Perhaps a load of camping and hunting equipment, or just a load of wood. If you wish to do the latter, get a bundle of 2¾ and 3-in. twigs, some crooked and some straight, and trim the bark off. Then tie them onto the packsaddle.

TWO-TONE FINISH ON OAK

(Continued from page 215)

10. Apply scaler coat of lacquer or varnish.

a) Prepare scaler coat by using equal parts of lacquer and lacquer reducer.

b) Let dry.

11. Apply several coats of lacquer or varnish. Allow 2 hours between coats if using lacquer, and 48 hours if using varnish.

12. Finish sanding. Sand with No. 360–A or No. 400–A wet or dry sandpaper. Use water or sanding liquid as lubricant. For high polish, use rubbing compound and clean up with furniture polish.

Questions:

1. Why is it necessary to get the paint very thin?
2. Why apply the wash coat of shellac before applying the filler?
3. Should the priming coat be wiped? Why?
4. On what type of furniture is this finish frequently applied?

A CHILD'S NAPKIN RING

F. CLARKE HUGHES
Spokane, Wash.

(See illustration on page 216)

The accompanying illustration shows a project that is not only interesting to the average high school student but has the advantage that it can be made from small scraps of hardwood that might otherwise be wasted.

A well-selected variety of woods, such as the combination suggested in the illustration, is very essential to the success of this project.

The Base: The base is a simple faceplate job, well within the ability of the average junior high school student. If the size is too small for the smallest faceplate, the stock may be glued to a larger disk of soft pine with a piece of thick paper separating the two pieces.

The Body: The rough stock for the body should be bored with a 1½-in. auger. The inside of this hole should be sanded smooth before being fitted to the pine core shown in the left-hand lower corner. This pine core should be fitted snugly enough to allow the outside shaping.

The two sides of the body to be flattened, as shown by the dotted lines, may be shaped with either the plane, saw, or belt sander.

The Head: The head is a simple part to be turned, as is the shaping of the beak and tail. The beak and tail should be made of material ⅜ in. thick.

All of these parts should be sanded perfectly smooth and assembled with a good grade of glue.

Any of the standard finishes for hardwoods may be used to complete this project. In any case the finish should be one that brings out the natural beauty of the wood.

Personal News

♦ Lt. Col. Verne C. Fryklund, director of the teacher-training department of the Armored Force School, Fort Knox, Ky., has been appointed War Department representative in Washington, D. C., in connection with the preinduction training program.

♦ J. I. Lockhart has been appointed head of the industrial-arts department at the Waukegan Township high school. He replaces Paul L. Schoenoff who has held the position for the past two years. The directorship of the school's Federal Defense classes, also previously held by Mr. Schoenoff, has been transferred to Howard Jackson. Both Mr. Lockhart and Mr. Jackson

(Continued on page 22A)

A New Machine
FOR THE SCHOOL SHOP

Now for the first time it is possible to consider surface grinders as practical equipment for school shops. For here in this new Delta machine is a husky, accurate, portable Surface Grinder at new low price levels — a versatile machine with many specific advantages not found in grinders costing many times as much. It is ideal for instructing students on surface grinding operations and is valuable for machine shop maintenance work.

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Improved, well-designed spindle — the "heart" of any Surface Grinder — made extra-long with bearing at either end, widely spaced. Forward bearing is large surface taper bronze bearing of design usually found only in much more expensive grinders — rear bearing is sealed-for-life ball bearing.

Special Wheel Mounting System — utilizes two-piece adapter so that either wheel, or wheel and adapter, can be removed. Thus once wheel has been trued up, wheel and adapter can be removed and replaced without need of re-dressing wheel.

Improved Table — smooth operating, with conveniently located control handles — has long ways so that table rides solidly. Gibs provided so that all play due to wear can be eliminated. Micrometer collar, with wide graduations on the traverse adjustment permits accurate settings. The table is provided with T-slot for clamping fixtures or magnetic chuck in place.

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THE ARMY-NAVY "E" — awarded for excellence in the production of machine tools vitally needed in the war effort.

Detroit Public Library

(Continued from page 20A)

are machine-shop instructors. Mr. Schoenoff teaches printing.

♦ EARL I. GIFFIN is co-ordinator for the series of War Emergency classes being offered at the Waukegan Township high school by the University of Illinois. Classes in electricity, safety engineering, and personnel problems are being offered at the present time. Mr. Giffin teaches drafting at the high school.

♦ FIRST LT. SIDNEY C. CARPENTER has been appointed director of the teacher-training department of the Armored Force School at Fort Knox, Ky.

Lt. Carpenter is a former industrial-arts teacher. He is a graduate of Western Kentucky State Teachers College, Bowling Green, Ky., and took his graduate work at the University of Missouri under the late Prof. Selvidge.

He taught at the Navy Pier, Chicago, Ill., before entering the armed service.

♦ GUY O. TOLLERUD, who was serving as war-production supervisor of the southern Minnesota area, has been promoted to the position of state supervisor of war-production training. He will take over his new duties immediately.

Mr. Tollerud began teaching at the Austin High School almost twenty years ago. He has headed the industrial-arts department for the past 15 years. The present enrollment of this department is now over 621 students.

Mr. Tollerud became co-ordinator and supervisor of defense training in 1941. Since that time a large program of war-training courses has been developed and much shop equipment added. Over 573 people have been trained to date and employed in war plants in all parts of the United States. He was appointed area supervisor of southern Minnesota last spring, in addition to directing the Austin program.

♦ OSCAR LINDSTROM, class of 1936, The Stout Institute, Menomonie, Wis., is a civilian instructor at the Lincoln Army Air Base in Nebraska.

♦ WILLIS GIESE, 1936 graduate of The Stout Institute, Menomonie, Wis., is with the United States Employment Service at Washington, D. C.

♦ RUSSELL HAYES, of Neenah, Wis., who will be graduated the first part of April from The Stout Institute, Menomonie, Wis., will teach industrial arts at Elkhorn, Wis., for the remainder of the year. He has accepted a position to teach industrial arts next year at the high school in New London, Wis.

♦ MAJOR JEFFERSON CRANK, class of 1932, The Stout Institute, Menomonie, Wis., was awarded a silver star for distinguished service in New Guinea where he recently saw action with the 32nd division.

♦ FRANK B. PERRSON, from the class of 1941, The Stout Institute, Menomonie, Wis., is in charge of the machine-shop division of the Army Air Force Technical Training Command at Yale University.

ROBERT RUDIGER of The Stout Institute, 1943 class, is supervisor of the power-plant division also at Yale.

♦ PETER BLOM, a sophomore at The Stout Institute, Menomonie, Wis., this year, is receiving recruit training at Camp Farragut, Idaho.

♦ NORMAN JENSEN, LLOYD HARMON, and LOUIS SCHMIDT, Navy V–7's, who graduated in January from The Stout Institute, Menomonie, Wis., have begun training at Columbia University.

♦ ARTHUR OTTASON, class of 1941, The Stout Institute, Menomonie, Wis., is an assistant senior instructor of the electrical systems of military aircraft at the Lincoln Air Base in Nebraska.

♦ CHARLES FINNEY, who was graduated from The Stout Institute, Menomonie, Wis., in 1941, reported for duty recently at Boca Raton, Fla., as engineering cadet in the Army air force. He has been a civilian instructor at the air field in Lincoln, Neb.

♦ CHARLES H. ROMINE, a member of the 1935 graduating class of The Stout Institute, Menomonie, Wis., is in the Navy fleet at San Francisco, Calif.

♦ DON INGRAM, who was a senior at The Stout Institute, Menomonie, Wis., this year, is in the Air Corps Training Group at Miami Beach, Fla.

♦ ENSIGN GERALD HAWKINSON, 1942 graduate of The Stout Institute, Menomonie, Wis., has been home on a five-day leave. He was commissioned an ensign at the Navy Pier, Chicago, Ill., on March 5, 1943.

LAWRENCE CLARK and NEIL BLACK also received ensign commissions at the same time. These men have completed their officer's training course at Northwestern University, Evanston, Ill., and are now going to the Navy base in San Francisco, Calif.

♦ LT. PALMER BREKKE, graduate of the 1939 class, The Stout Institute, Menomonie, Wis., is in the United States Navy at the Bethlehem Steel Company Shipbuilding Division at Quincy, Mass.

♦ ROBERT LEROY SANDIN, former student at The Stout Institute, Menomonie, Wis., has recently been appointed an instructor at Dunwoody Institute at Minneapolis, Minn.

♦ OSCAR EMBRETSON, 1937 class, The Stout Institute, Menomonie, Wis., and formerly of La Porte, Ind., is now a lieutenant at the Indoctrination School, Jacksonville, Fla.

♦ ELLSWORTH C. DENT, formerly RCA Educational Director, has been appointed general manager of the Society for Visual Education, Inc., Chicago, Ill. He will begin his new duties in April.

Mr. Dent received his early training in education at the Kansas State Teachers College of Emporia. This was followed by graduate work in education while in charge of the Bureau of Visual Instruction, University of Kansas, a service organization for the schools of Kansas. During his ten years at the University of Kansas, he expanded the visual instruction services to meet the growing needs of schools, including one of the first loan libraries of educational slidefilms.

(Continued on page 25A)

"It Takes a Tool that's Precision Built to Do Precision Work"

Just as water never rises higher than its source, so is the accuracy of your tool and die work limited by the accuracy of the tools, machines, and instruments you use. This is most important in your grinders, because grinding governs the most critical dimensions. Working to tolerances of one ten-thousandth is every-day practice with Dumore precision grinders, because these grinders are themselves built by craftsmen who work and think and talk in terms of a tenth. Equally important and equally accurate is the control of all inertia forces by dynamic balancing of supreme sensitivity — not by assemblies, but piece by piece and part by part. See for yourself the secrets of Dumore precision in the drawing below.

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1. MOTOR HOUSINGS are compact and sturdy . . . designed for easy portability.
2. PRE-LOAD SPRING assures smooth running bearings at high speeds. (Pat. 2,188,251.)
3. PULLEYS are balanced to increase belt life and give full power transmission.
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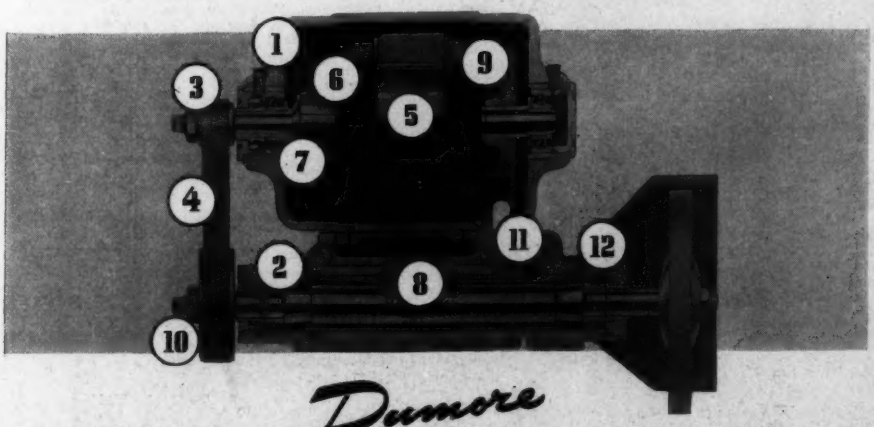
5. DYNAMIC BALANCING of armatures and rotating parts prevents vibration and increases precision.
6. PRE-EXPANDING armature windings, then double-dipping in enamel and baking them, prevents centrifugal "breathing."
7. LEAD WIRES are swaged to commutators by special Dumore process to assure 100% electrical contact permanently.
8. "FOG-OF-OIL" LUBRICATION to the quill bearings. A felt tube within the quill, extending to tapered ends of the main spindle, is held in place by a metal liner. Fingers at each end of the felt tube ride on the spindle surface, tapered to form an oil slinger. As the spindle revolves, it picks up a minute amount of oil from these fingers and the taper throws the oil into the bearings in a fog. (Pat. No. 1,859,068.)
9. FAN DRAWS air in through a filter, provides blast to keep both motor and quill cool.
10. AUTOMATIC BELT TENSION gives long belt life and maximum power transmission.
11. FRAME CONSTRUCTION assures rigid mounting, required in precision grinding.
12. BALL BEARINGS selected with infinite care for hours of vibrationless running.



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VISUAL AIDS for TEACHER TRAINING
The complete series including nine slidefilms, eight recorded lectures and a complete instructor's manual sells for $52.50

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A 40-page manual is provided free. It contains suggestions to help the instructor get maximum value out of the use of the slidefilms.

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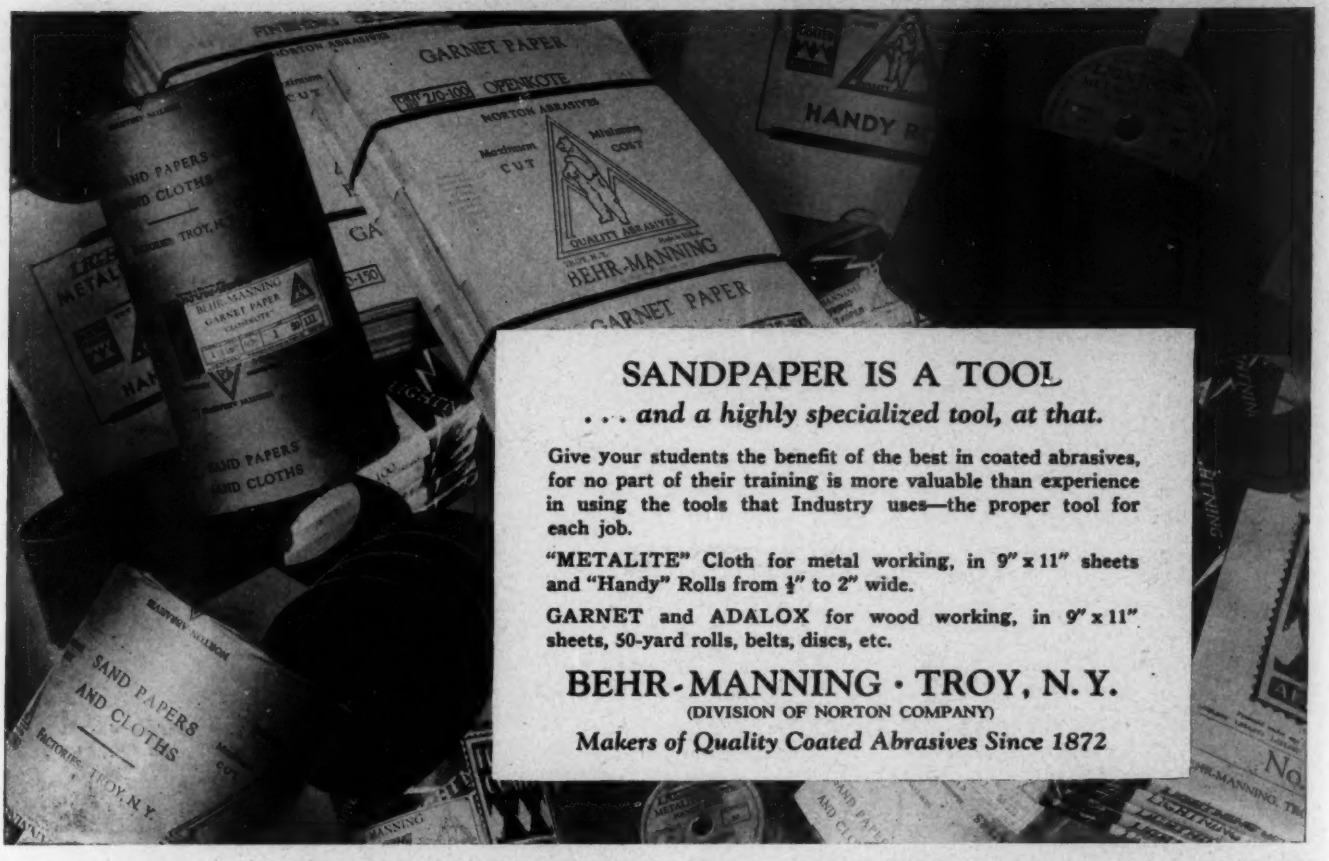

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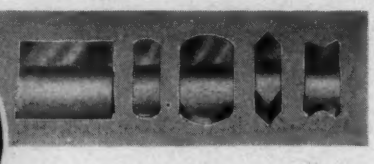

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HAVE you figured your department couldn't afford the cutter equipment to add originality in finish to your projects? Then you have never had the full facts about Carter Bits and Cutters.

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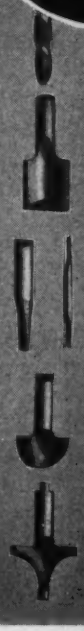
Write today for a folder describing Carter Bits and Cutters, then order the selection you need to give your class work cabinet-maker style and quality. **R. L. CARTER DIVISION,** The Stanley Works, 112 Elm Street, New Britain, Connecticut.



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CARPENTRY AND JOINERY WORK
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The new edition has been completely revised and set in easy reading type. Designed as a high school beginner's text it includes corollary subjects of Carpentry Mathematics, Architectural Drawing, Blueprint Reading and Business English. A full set of working blueprints and a material list help the student master estimating. Glossary and Index.
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HOUSE CONSTRUCTION DETAILS
By Nelson L. Burbank

Hundreds of clearly drawn and scaled details and photographs of all important sections of houses are brought together in this book. Chapters follow the sequence of construction work. An ideal reference book for drafting classes.
1942. 2nd. 314 pages, 1,500 illus., 8½ x 11½, cloth, $3.00

PRACTICAL JOB POINTERS
Compiled by Nelson L. Burbank

Kinks, short cuts and modern methods for doing all kinds of building jobs. Six hundred ideas from men on the job. Each is accompanied by a sketch.
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SHOP CRAFTER'S MANUAL
By N. L. Burbank and E. M. Mitchell

A selection of 150 projects ranging from simple gadgets to fine pieces of furniture which the amateur can make. Clear working drawings show all important details. Full instructions and material lists.
1942. 142 pages, 300 illus., 8½ x 11½, cloth, $2.00

SIMPLIFIED CARPENTRY ESTIMATING
By J. Douglas Wilson and Clell M. Rogers

A beginner's text showing how to "take off" from a set of blueprints and specifications a bill of materials for a frame house. Mr. Wilson has taught the subject for many years. The mathematical short cuts were contributed by Mr. Rogers, a mathematics instructor.
1940. 208 pages, 71 drawings, 5 x 7, cloth, $2.50

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SIMMONS-BOARDMAN PUBLISHING CORPORATION
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Peerless Metal Cutting Power Saws Cut Straight and Fast

Students should know *why* it is so easy to cut metals faster and to close tolerances with Peerless Metal Cutting Saws. Here are some of the reasons for this Peerless accuracy and speed.

There is no bowing, tilting or side-play of the blade because of the Peerless Four-Sided Saw Frame and Backing-Plate Blade-Support. Full protective features relieve blade of sudden shocks. Chips are cleared from the cut, not wedged in.

Shapes of all kinds are handled speedily. Compensating feed adjusts itself to shape and size of work, cutting faster on round and thin sections.

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PEERLESS MACHINE COMPANY, Racine, Wisconsin

Standard Models in Five Sizes for Maintenance and General Utility Cutting.

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Please mail ☐ Catalog of Peerless Standard Power Saws
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Peerless
THE ONLY METAL CUTTING SAW WITH FOUR-SIDED SAW-FRAME AND BACKING-PLATE

Fast ACCURATE Sawing DEMANDS PEERLESS BLADE CONTROL

(Continued from page 22A)

The bureau also maintained an equipment recommendation service, to aid schools in the selection of projectors, screen, cameras, and materials.

He also organized the visual instruction service for the Inter-Mountain Area, at Brigham Young University, Provo, Utah, and spent three years with the United States Department of the Interior, where he became director of the Division of Motion Pictures and supervised the production and distribution of pictures, films, and slidefilms for educational use.

He is author of *The Audio-Visual Handbook*, now in its fourth edition, which is widely used as a text and for reference in audio-visual training courses and by school executives.

♦ EUGENE F. MOOD, of Wichita, Kans., joined the trade and industrial staff of the State Board for Vocational Education on March 1 to assist in the war-production training program. He will have his headquarters in the Topeka office and will be responsible for records, reports, and equipment inventories in the local centers. Mr. Mood comes to the state board from the Waco unit of war-production training at Wichita, Kans., where he was supervisor of the night shift.

♦ P. W. CHAMNESS, director of vocational education at Topeka, Kans., has been appointed chairman of the Adult Education Round Table for the Kansas Teachers Association to be held next fall.

♦ GLENN E. BEST, formerly head of the industrial-arts department at West Virginia Institute of Technology, Montgomery, W. Va., has been commissioned Lt. Comdr., U.S.N.R.

Lt. Comdr. Best has 20 years of experience in teaching, supervision, and administration work.

He has a diploma from The Stout Institute, Menomonie, Wis.; he received a B.S. degree in industrial education from West Virginia University, Morgantown, W. Va., and a M.A. degree in industrial-arts education from Ohio State University, Columbus, Ohio.

Lt. Comdr. Glenn E. Best

In the last war, Lt. Comdr. Best served in the United States Marines, seeing active service in the Argonne, and in the Army of Occupation in Germany.

Learn to get along with people.
Learn to exhibit more patience than any other man you know.
Learn to respect other men's ideas and opinions.
Learn to think problems through to the end.
Learn to try to put yourself in the other fellow's place.
Be democratic.
Be loyal.
Cultivate cheerfulness.
Work. — *Harry J. Klingler*

Association News

♦ The Twelfth Annual Indiana Industrial Education Association Convention, originally planned to be held March 26 and 27, will be held at Indianapolis May 7 and 8, 1943.

♦ The Association of Teachers of Industrial and Practical Arts in Day High Schools, New York City, adopted their constitution and elected officers, Saturday, March 13, 1943.

There were 60 charter members present.

Officers chosen in the organization's first election were: Harold E. Taylor, first assistant in mechanical drafting at Brooklyn Technical High School, president; Abner Rosenblum, teacher of bookbinding at Franklin High School, recording secretary; Mrs. Sylvia K. Sonder, teacher of art weaving at Lincoln High School, corresponding secretary; and Alfred Schaefer, teacher of mechanical drafting at Stuyvesant High School, treasurer.

♦ New Epsilon Pi Tau members of Stout Institute were initiated formally on February 28 at a ceremony which ended with a luncheon.

The initiates were Ray Chartraw, Carl Erickson, Harland Hesselman, Paul Ingwell, Lothar Mueller, Louis Ode, Zenas Prust, George Soderberg, and Rudolph Wagner.

♦ The Regional Conference of the National

(Continued on next page)

(Continued from previous page)

Graphic Arts Education Association will convene in Rochester, N. Y., on Saturday, May 1. All meetings will be held at the Rochester Athenaeum and Mechanics Institute.

An interesting program is being formulated for the benefit of printing teachers and craftsmen.

The theme subjects of paramount importance to be discussed will be: apprentice training, post-war rehabilitation, problems in printing education raised by war emergencies, and training of women for the printing profession.

Among those who have already accepted invitations to speak are the following:

Hupp Otto, president, National Graphic Arts Education Association.

Harry L. Gage, vice-president, Mergenthaler Linotype Co.

John A. Backus, educational director, American Type Founders Sales Corp.

Prof. Bristow Adams, dean of the School of Journalism, Cornell University.

Lawrence B. Siegfried, university printer, Syracuse University.

Horace Hart, president, Rochester Typothetae, Inc.

Miss Marjorie Lush, director of art, Rochester school system.

Miss Edwina B. Hogadone, supervisor, retailing department, Rochester Athenaeum and Mechanics Institute.

Dr. Mark Ellingson, president, Rochester Athenaeum and Mechanics Institute.

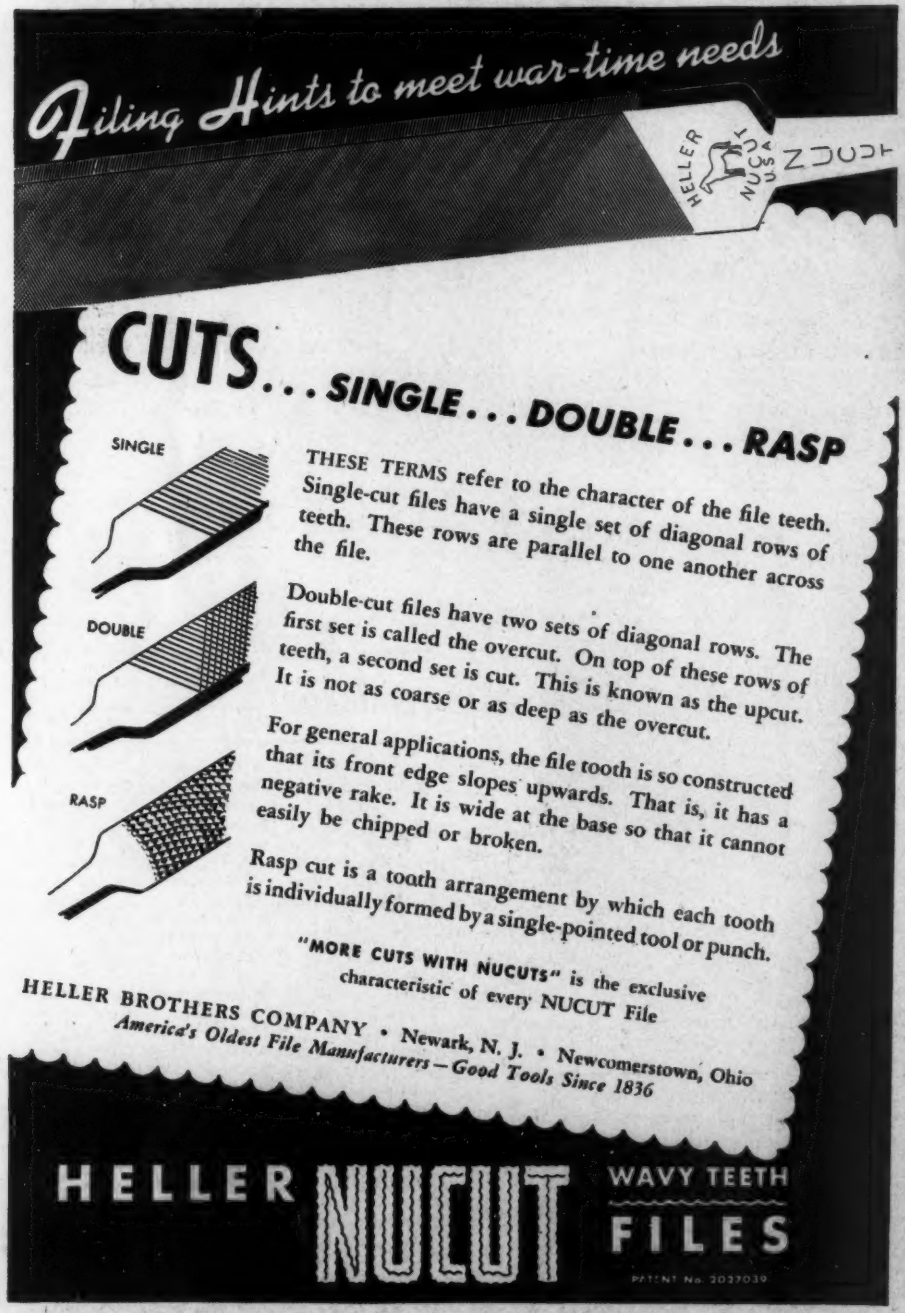
Byron G. Culver, supervisor, publishing and printing department, Rochester Athenaeum and Mechanics Institute.

Those on the committee arranging this conference are: Joseph F. Sorace, regional vice-president and general chairman; Byron G. Culver, arrangements; Frank DeWitt, registration chairman; and Donald L. Ritchie, chairman of dinner committee. — *Joseph F. Sorace*

♦ The spring meeting of the Industrial Arts Teachers' Association was held on March 9, 1943, at Newark, N. J. The topic of the round-table discussion was "Problems That Confront the Industrial-Arts Teacher." — *H. G. Stintsman.*

♦ The annual initiation of the Mu Sigma Pi fraternity, Wayne University, Detroit, Mich., was held recently at Mackenzie Union. Mr. Ernest Doll was chairman of the ritual committee, and was in charge of the initiation.

Charles Sechrest introduced Dr. Arthur Carr, dean of the College of Engineering at Wayne University, who served as the toastmaster of the evening.


Filing Hints to meet war-time needs
HELLER NUCUT
CUTS... SINGLE... DOUBLE... RASP
SINGLE
DOUBLE
RASP
THESE TERMS refer to the character of the file teeth. Single-cut files have a single set of diagonal rows of teeth. These rows are parallel to one another across the file.
Double-cut files have two sets of diagonal rows. The first set is called the overcut. On top of these rows of teeth, a second set is cut. This is known as the upcut. It is not as coarse or as deep as the overcut.
For general applications, the file tooth is so constructed that its front edge slopes upwards. That is, it has a negative rake. It is wide at the base so that it cannot easily be chipped or broken.
Rasp cut is a tooth arrangement by which each tooth is individually formed by a single-pointed tool or punch.
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Standing, left to right: Arieus J. Croteau, Harold A. DeLong, Charles L. Pozzini, Arthur J. Elges. Sitting, left to right: Thomas O. Monroe, Wm. M. Jones, and C. Paul Nutten

The speaker of the evening was Mr. John Dancey, director of the Urban League, who presented the problems confronting young Negro workers in Detroit.

A buffet supper was served. Richard Carlson, O. R. Dickerson, Arthur Dunham, and Francis Zwickey were in charge of arrangements.

Mr. William M. Jones was presented with an honorary membership. Mr. Jones is well known in the Detroit area for the work that he has done in stimulating activity in the building of birdhouses.

♦ A one-day conference of local supervisors of trade and industrial education, teacher trainers, and school administrators of the state of Illinois was called by J. W. Thompson, state supervisor of trade and industrial education of the state of Illinois, March 26, 1943. It was held at the Morrison Hotel, Chicago.

The chairman of the forenoon session was Paul Grigsby, principal, Community High School, Granite City, Ill. The program consisted of a round-table discussion on the question of whether the administration of the full-time general industrial and unit trade courses would be made easier, and at the same time promote the efficiency of these courses if the time for shopwork were extended to at least three and one-half to four clock hours per day, with necessary related instruction included, the remainder of the day to be given over to the regular high school program. The panel members were Paul A. Grigsby, leader; Earl H. Hanson, superintendent of schools, Rock Island; Charles E. Lang, principal, Lane Technical High School, Chicago; S. B. Sullivan, principal, Community High School, West Frankfort; Earl C. Douglas, supervisor, Trade and Industrial Education, Joliet; and Paul L. Roise, supervisor, Trade and Industrial Education, Cicero.

(Continued on page 28A)

GOOD TOOLS

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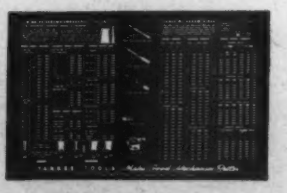
Two principles determine the design and manufacture of "Yankee" Tools: (1) They must make work quicker and easier than other tools manufactured for similar work; (2) they must be precision-built, tested and re-tested for quality and dependability. . . . Strict adherence to these principles has made "Yankee" Tools the favorites with good mechanics and the instructors of good mechanics for more than a half century. That is why the war-time demand for "Yankee" Tools is greater today than our ability to make them immediately available for vocational needs.

FREE! This handy "Yankee" Reference Chart features tables of relative screw driver blade and screw sizes, and includes graphic instructions on how to drive screws correctly. Write for your copy.



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Established 1880

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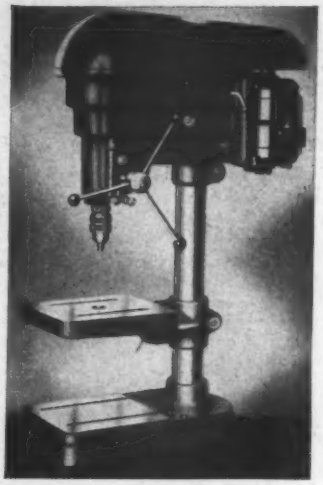

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Sealed against hazards common in other presses. The only drill press priced under $100.00 that gives you an approved guard without extra cost; the first guard that allows easy speed changing.

5 carefully predetermined efficient speeds, one for every operation. New self-centering 30-degree pressure angle 6-tooth involute spline. Spindle, quill, and spindle-pulley are held in permanent, perfect alignment.

The quill, longer and larger in diameter, is held by three bearings, permitting long holes to be drilled more accurately than by other presses in same price range. It is unquestionably the most durable and sensitive of any press in its class.

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for Helmet Head Drill Presses

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(Continued from page 26A)

The discussion brought out the following points:

1. Schools are to be administered for instructing students, not for the convenience of the administration.

2. Vocational education helps to give students a better insight into everyday life than do such courses as general English and foreign languages.

3. It is difficult to find the right kind of related-subjects teachers who make their work in the classroom practical and not abstract.

4. The related work in the shop should include an understanding of labor and economic problems.

5. Cultural subjects should receive attention because the student must be a citizen besides being a wage earner.

6. Education, not mere training, must be the aim of the school.

7. It is well to make our teachers of English, mathematics, and science more vocationally minded.

8. The pupil's day is now six hours. If the shop period is to be lengthened, it would be well to lengthen the school day.

The chairman of the afternoon session was J. Morgan Johnson, supervisor, Trade and Industrial Education, Moline.

The main speaker on the program was Arthur B. Mays, professor, Industrial Education, University of Illinois, Urbana. His subject was "Training Trade and Industrial Teachers in Times of War and Times of Peace."

He emphasized that:

1. A teacher-training institution can do nothing more than to prepare a teacher so he can get started.

2. Industrial teachers must have practical experience, but a statement of the number of years of such experience has little meaning.

3. Men who have had eight years of practical experience, even if they are high school graduates, rarely care to spend the time required to finish a college course to obtain a teacher's diploma.

4. Applicants who have practical backgrounds usually have very strong opinions. They think of the product being made rather than of the boy being trained.

5. Teachers are confronted by the triple problem of teaching boys "what to do, what to know, how to change so as to become a good mechanic."

6. Teachers must command respect. They must not permit their students to become too familiar. They must be able to organize a class and prepare a course of instruction.

7. The state department of education can assist by setting up good certificating procedures, appointing well-qualified teachers, providing sympathetic supervision, and issuing printed helps to the teacher.

8. Teacher-training institutions can assist by providing resident courses, conferences, and itinerant instructors.

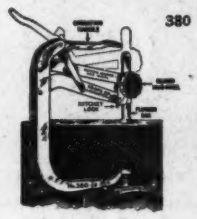
9. High school principals can assist by taking an interest in their shop teachers, helping them to get a professional outlook, urging them to join professional organizations and to read professional literature, and assisting them in making suitable local public relations contacts.

The chairman of the banquet, which was held at 6 p.m., was J. W. Thompson.

The main addresses on this occasion were made by Dr. L. S. Hawkins, chief of training, U. S. Office of Education, and Vernon L. Nickell, state superintendent of public instruction, Springfield, Ill.

Make Your Toolbox Earn a PROFIT!

Today, more than ever, the automobile mechanic must make every minute count. Correctly designed and carefully made tools can save minutes and even hours on every job. K-D Tools are made by automotive men with these very thoughts in mind.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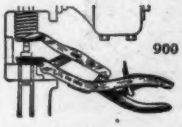
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125

VALVE SPRING COMPRESSOR

380 For most motors, old or new, L- or valve-in-head. Automatic depth adjustment. Cam-locking operating handle. The fastest Compressor of its kind. 2 sets jaws (straight and offset) furnished, both adjustable.

VALVE LIFTERS

600 An old favorite, thousands giving satisfaction. 10" long. Tempered jaws are adjustable. Improved safety ratchet lock.

900 For under-fender use on late cars. Offset so you can see what you're doing. *Exclusive*—built in auxiliary jaws for extra high lift when needed. Safety ratchet lock. Adjustable, tempered jaws. 8¾" long.

VALVE KEEPER INSERTER

605 Installs 'most all split keepers. Thumb pads make loading easy. Supports self on valve stem. Ideal with 600 and 380 above.

IGNITION TOOLS

115 Aligns *all* points, right in distributors. Carefully machined to fit 'em all. Tempered for dependable service. Thousands in use.

125 Refaces points after aligning. Genuine abrasive stone puts a square and parallel finish on both points at once. 4 wheels furnished. Positive 2-to-1 chain drive.

GUIDE PULLERS FOR FORD

920 Set, consists of Driver to remove retainers and Puller to remove assemblies. For Ford 85, Mercury, Lincoln-Zephyr and Tractor. Gets right under guides and pulls assemblies, no matter how tight, without fuss or delay. 860 Set, similar in design, for 60 HP.

BAR LIFTERS FOR FORD

240 For replacing guide assemblies. Not for removing. Channel steel, tempered. Services all Ford motors except 60 HP. and Lincoln-Zephyr. 260 similar design for 60 HP.

VALVE GRINDING TOOLS

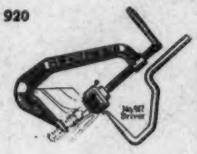
1118 Bushing, used in place of guides when grinding and when establishing clearance in 85 HP., Mercury, Lincoln-Zephyr and Tractor. No. 1160 for 60 HP. All accurately machined, hinged as shown.

503 Vacuum Cup (1¾") Valve Grinder with safety metal retaining ring to keep cup centered. Flange keeps hands in place. No. 865 with 1⅛" cup for smaller valves.

FOR "HARD-TO-GET-AT" JOBS

10 Pliers Set in non-spill metal box. Each 4¼" long, with milled jaws and knurled handles. Good tough-tempered little tools.

20 Ratchet Set. Openings ⅜", 7/16", ½", ⅝" with screwdriver bit. In fabric kit. Short handles and close teeth for work in tight places.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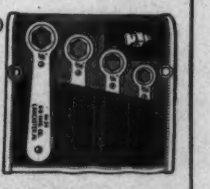

20

You can see these K-D Tools, and over 40 others, at your jobber's. If you would like a new K-D Catalog, write to the factory. It's free.

K-D Manufacturing Co., Lancaster, Pa.
AND HAMILTON, ONTARIO

News Notes

♦ The shortage of skilled engineers and draftsmen at Wright Field has made it necessary to assign engineering and drafting aids as assistants.

In order to increase the supply of these aids, the Civilian Personnel Section at Wright Field is conducting a training school for qualified trainees. This course is sponsored by West Virginia University, under an agreement with the U. S. Office of Education.

To be accepted on this training program, applicants must have a high school diploma and must have taken three years of high school mathematics. They must have an aptitude for science or mechanics or drafting as evidenced by having taken related high school courses such as physics, chemistry, drafting, etc. Women trainees are preferred, though male trainees may apply.

Individuals interested may make application by obtaining and filling out a Civil Service Form 57, which can be obtained at any Civil Service office, and forwarding it to the Employment Unit, Garfield Building, Fourth and Jefferson Streets, Dayton, Ohio, attention of Lt. James L. Gaylord, Chief. A short letter should be attached to the form stating that the applicant wishes to be considered for engineering aid or for drafting aid training.

♦ Counselors, deans, teachers, librarians, students, parents, and others interested in vocational guidance will find helpful material in a new list of 25 free pamphlets on 17 different occupations, including names and addresses of the publishers from whom the pamphlets may be obtained upon request. To get this list send 25 cents to Occupational Index, Inc., New York University, New York City.

♦ Preflight training films, released by the U. S. Office of Education, in 16mm. sound versions are now available for classroom use from The Princeton Center, Princeton, N. J. The pictures may be rented. These films, originally produced for U. S. Army and Navy aviation courses, are immediately useful for preflight training courses

(Continued on page 33A)

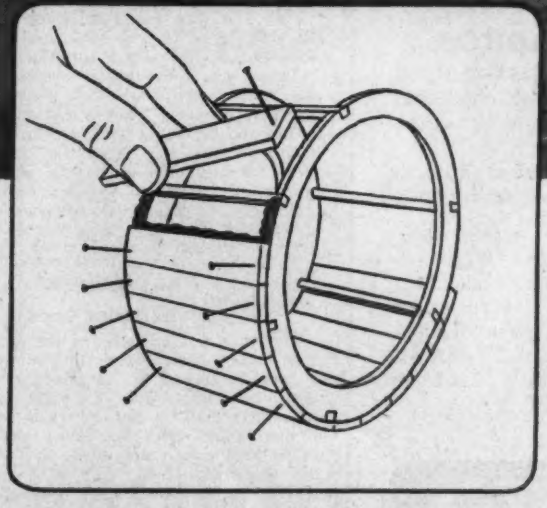
TESTORS

CEMENT AND DOPE FOR MODEL AERONAUTICS

FIRST CHOICE OF AMERICA'S MODEL BUILDERS

No. 5 in a Series on Principles of Better Craftsmanship

*HOW TO DO A GOOD PLANKING JOB



*Planking, on a model airplane, takes the form of thin flat pieces laid edge to edge to form a continuous surface, as shown in the picture above. The planks are usually fitted one at a time, each new piece being carefully cut to fit the preceding piece. To fasten a plank in place, lay a ribbon of Testor's Model Airplane Cement along the joining edge and on the formers and other pieces to which the planks are attached. Press the plank in place and hold with pins, clamps, rubber bands, string, or other means until the cement sets firmly. This will assure you a tough, strong planking job.

You will find these practical data sheets a helpful guide for your classes. May we suggest that you save and file the entire series.

Now! Get complete details about Testor's Model Airplane Cements and Dopes

TESTOR CHEMICAL CO., ROCKFORD, ILLINOIS, U.S.A.

Shop Equipment News

New Products — Publications

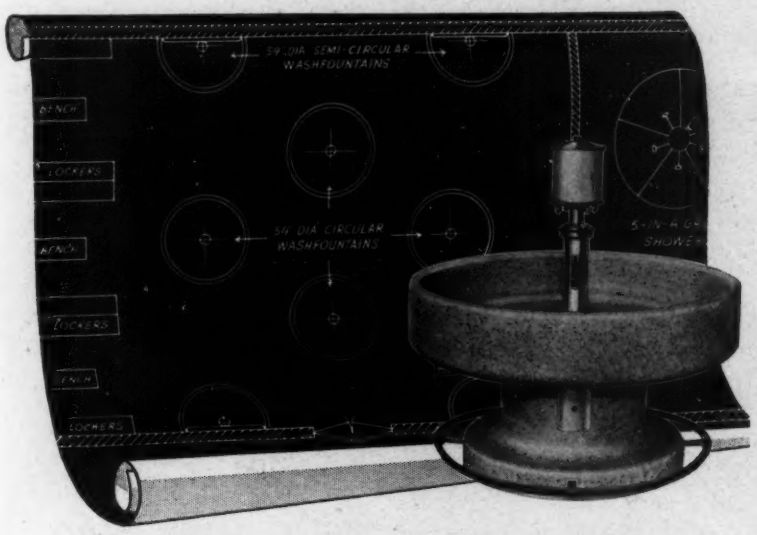
ATLAS ANNOUNCES NEW COOLANT PUMPS

Two compact, portable coolant pumps are being announced this month by Atlas Press Company, Kalamazoo, Mich. Easily adaptable to almost any machine tool, these units are designed to meet peak production demands.

Pumping capacities meet maximum-flow requirements of most makes of lathes, drill presses, millers, grinders, cutoff saws, screw machines, single and multiple spindle drilling and tapping machines. Centrifugal design of the Atlas coolant pumps increases rigidity, lengthens service life, and insures smooth, trouble-free performance. No priming is necessary. Complete coolant systems may be assembled by selecting feed and return units available.

For complete information and motor data on the new Atlas coolant pumps, ask for Catalog C43, Atlas Press Company, Dept. 7, Kalamazoo, Mich.

For brief reference use IAVE—510.



Let Us Help You Provide More Washing Facilities—in Less Space

Bradleys serve more students in less space — eight to 10 simultaneously at each group fixture. . . . They save 80 per cent of the piping connections (critical metal) because one Washfountain serves as many as eight to 10 "single-person" wash basins — 3 connections as against 24 to 30.

They save time and maintenance work. Contaminations and skin affections are reduced since each student washes in clean *running* water like a shower bath.

Provide more modern washing facilities NOW. . . . Our Washroom Consultants are ready to make floor plan suggestions and forward you a copy of our "Washroom Layout Booklet." . . . BRADLEY WASHFOUNTAIN CO., 2269 W. Michigan Street, Milwaukee, Wis.

BRADLEY washfountains

NEW ¼-IN. HEAVY DUTY DRILL

Announcement has just been made of the new *Model "47" Skilldrill* by Skilsaw, Inc., 5033–43 Elston Ave., Chicago, Ill. Designed especially to speed up tough "skin drilling" in airplane construction, *Model "47" Skilldrill* is ideal for countless production drilling jobs up to ¼ in. in steel and ½ in. in wood.

It has the power for real tough jobs, weighs only 3½ lb., is 7¼ in. long, and 2 9/16 in. wide.

This new Skilldrill has a diecast body, helical-cut gears, and antifriction bearings, assuring smooth, quiet running. The universal motor makes four speeds (1800, 2500, 3500, and 5000 r.p.m.) available. It has a two-pole momentary contact switch with lock for continuous operation.

For brief reference use IAVE—511.

MANUAL ON LATHE MAINTENANCE AND CATALOG ON 10-IN. PRECISION LATHES

An 8-page catalog, No. 10, describing South Bend 10-in. precision lathes has been recently issued by the manufacturer. It illustrates and describes South Bend 10-in. Toolroom Lathes and 10-in. quick change gear lathes in both floor leg and metal bench models. Attachments, accessories, and tools for use with these lathes are also listed.

The construction features of the lathes are illustrated and specifications are tabulated for ready reference. Both models are made in two types: "1-in. collet" and "regular." The former has a 1-in. maximum collet capacity and twelve spindle speeds (50 to 1357 r.p.m.). The latter has an 11/16-in. maximum collet capacity and six spindle speeds (50 to 700 r.p.m.). The swing over bed and saddle wings is 10⅝ in. for both types.

Copies of this catalog can be had by writing to South Bend Lathe Works, South Bend, Ind.

This firm also has just issued "Keep Your Lathe in Trim," a new booklet on lathe maintenance, lathe tests, and adjustments.

Among the many points covered by this 28-page booklet are the testing of motors and power supply; shortening, splicing, and adjusting belts; testing and adjusting spindle bearings; and adjusting dovetail gibs. Also, full information is given on how to measure and adjust the set-over of the tailstock top for realigning lathe centers and for taper turning. Numerous photographs and line drawings are used to illustrate the various methods of making these adjustments.

Write for a free copy.

For brief reference use IAVE—512.

TUBE PICTURE BOOK

The wide use of radio in the present World War makes it mandatory that many thousands of men be trained in the principles and fundamentals of this science. In order to be of assistance to teachers in the various fields of electronics, RCA Victor has issued several publications relating to radio tubes, their construction, and uses.

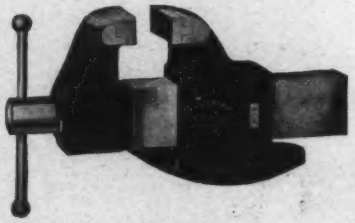
The latest publication, the 16-page RCA Tube Picture Book, has been prepared especially for use in radio war-training centers. It provides a visual medium for studying the constructional details of various types of vacuum tubes. It contains eight charts printed on one side of the sheet to facilitate their use for display mounting.

(Continued on page 33A)

TO ALL SCHOOLS!

Important Announcement

NEW PRIORITY REGULATION



A new high priority rating under the Controlled Materials Plan has now been made available to all schools. Such rating makes it possible for schools to purchase many items which in the past have been unavailable except upon application on PD-1A forms.

If your school needs such tools as Wrenches, Files, Chisels, Vises, High Speed Drills, Hammers, Mechanics' Tools, Soldering Irons, Screw Drivers and other tools and equipment of similar nature, we suggest you make up your order and send it to us, and we'll gladly furnish you with the necessary information on how we can supply these to you.

Orders will be filled in the order of their arrival.

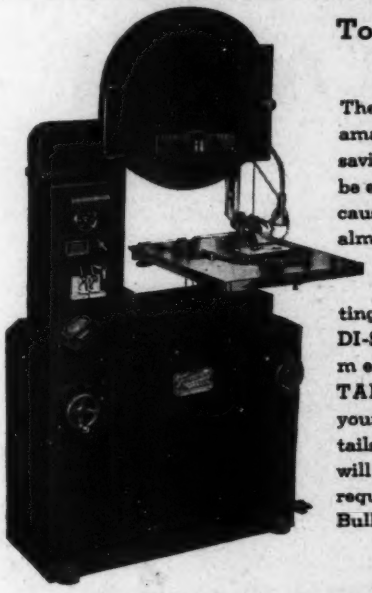
BRODHEAD-GARRETT Co.

"Supplying Defense Training Needs to Schools in All 48 States"

CLEVELAND • OHIO

Tannewitz DI-SAWS

are ESSENTIAL to Teaching MODERN Tool & Die Making



The innumerable and truly amazing time and money-saving shortcuts which may be effected by DI-SAWING is causing this equipment to be almost universally adopted by the leading shops. For inside and outside cutting, filing and polishing the DI-SAW is obsoleting other methods. Put the TANNEWITZ DI-SAW on your MUST list. Complete details of this exellent machine will be sent you promptly on request. Just ask for DI-SAW Bulletin.

THE TANNEWITZ WORKS, GRAND RAPIDS, MICH.

WALLACE
"MACHINE-OF-THE-MONTH"

NO. 28 SHAPER

2 H.P. geared motor rotates spindle 10,000 r.p.m. Reversing switch. Capacity for large cutters up to 2¾" wide. Vertical spindle adjustment 1½". Collet for routing bits extra.

For fast, smooth shaping work, this 10,000 r.p.m. gear-drive Shaper is without equal! Cutters and knives available for every kind of moulding and shaping operation. Adapter and collet permits use of small routing bits and cutters, adding extra versatility.

Cuts equally well with and against grain and on hard or soft wood.

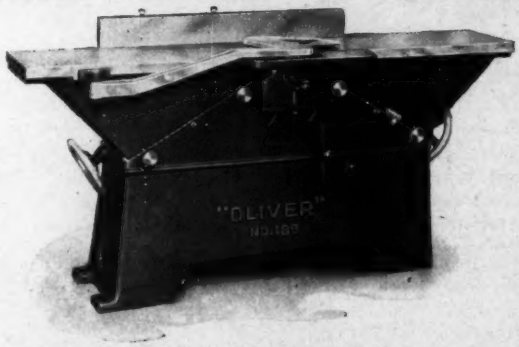
Write today for detailed bulletins and prices on the Wallace No. 28 Hy-Gear Shaper. We also manufacture quality Universal Saws, Radial Arm Saws, Bandsaws, Jointers, Mortisers, Lathes, Oilstone Grinders, etc.

J. D. WALLACE & COMPANY
140 S. CALIFORNIA AVE. CHICAGO, ILL.

Greater capacity and accuracy for the school shop

OLIVER

HAND PLANER AND JOINTER



An efficient and safe jointer for school use is the Oliver No. 189. It will perform a variety of work including squaring, smoothing, jointing, beveling, rabbeting, grooving, tenoning, etc. Built with the finest quality materials and containing all safety devices, this machine is ideal for school shop use.

Send for information on this machine and also on "Oliver" Junior machines, including Band Saws, Boring Machines, Saw Benches, Jointers, Speed Lathes, Mortisers, Surface Planers, Belt Sanders, Shapers, etc.

Oliver Machinery Co.
Grand Rapids, Mich., U. S. A.

Specify
"Jorgensen"
CLAMPS
for
HIGHEST QUALITY

NO. 70 JORGENSEN STEEL "I" BAR CLAMP

HAND SCREWS

NO. 40 JORGENSEN STEEL BAR CLAMP

NO. 50 PONY FIXTURES

8 types of steel Bar Clamps with patented Multi-disc Clutch that slides to position and grips rigidly-squarely at any desired point; and 4 Types of Pony Fixtures (with exclusive patented Multi-disc Clutch) that go on ordinary pipe to make Clamps of any length.

The "Jorgensen" Trade Mark on the jaws of all genuine Jorgensen Handscrews guarantees: selected grain, aged and treated jaws that will not split; Handles that will not loosen; Right-Left Screws that speed operation; Clamps that take a firm grip at any angle and hold it.

A Complete Selection

"Jorgensen" Drop Forged "C" Clamps
"Jorgensen" Welder "C" Clamps
"Jorgensen" Malleable "C" Clamps, 4 types
"Pony" Miniature "C" Clamps, 14 types
"Colt" Eccentric Bar Clamps, 5 types
"Pony" Malleable Latha Dogs

Write for No. 16 General Clamp Catalog

ADJUSTABLE CLAMP CO.
"The Clamp Folks"
424 N. Ashland Ave., CHICAGO

(Continued from page 30A)

The charts show structural details of representative receiving, transmitting, cathode-ray, and special tubes.

Teachers and students in the United States and Canada may secure copies of this publication at 10 cents each, by calling at an RCA Tube Distributor, or by writing the Educational Department, RCA Victor Division, Radio Corporation of America, Camden, N. J.

For brief reference use IAVE—513.

BOOKS FOR THE VICTORY PROGRAM

The McGraw-Hill Book Co., 330 West 42nd St., New York City, have just issued their 1943 spring catalog of books for the Victory Program.

This catalog lists a wide variety of text and reference books for preflight, preinduction, and war-production training programs.

A copy of this catalog is available for all those who want it.

For brief reference use IAVE—514.

CATALOG ON RADIO AND ELECTRONICS

The 1943 catalog on radio parts and accessories has just been published by Allied Radio, 833 West Jackson Blvd., Chicago, Ill.

It covers everything pertaining to radio and electronics quite fully.

For brief reference use IAVE—516.

HOW TO TAKE CARE OF PAINT BRUSHES

A pamphlet, "Care and Conservation of Brushes," has just been made available by the Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

Care of brushes is highly important in these days when the majority of brushes necessarily have to be made of horsehair set in substitute cements.

The book not only explains how to care for these emergency brushes, which are made with 55 per cent bristle and 45 per cent horsehair or other adulterants, but also shows how old, hardened brushes may be reconditioned for future use.

For brief reference use IAVE—515.

AN INDUSTRIAL LABORATORY

Recognizing that many of the outstanding developments of the war will come out of laboratory test tubes, The Franklin Glue Company, Columbus, Ohio, has just completed the installation of its enlarged and modernized laboratory.

According to Langdon T. Williams, president and general manager of the company, which manufactures Franklin Glue, a liquid hide glue in ready-to-use form, this laboratory is engaged in constant experimentation to solve adhesive problems arising from the war effort.

Robert F. Snider is laboratory director and is assisted by a staff of chemists and technicians.

RECENT ARMY-NAVY "E" AWARDS

The Army-Navy "E" Award has recently been given to The Columbian Vise and Manufacturing Company, Cleveland, Ohio; Stanley Tools and Stanley Electric Tools, New Britain, Conn.; and the L. S. Starrett Company, Athol, Mass.

Each of the selected plants will be privileged to fly the Army-Navy Production Award Pennant and all of their civilian employees will be awarded Army-Navy "E" pins.

NEWS NOTES

(Continued from page 28A)

in colleges, high schools, technical schools, etc.

The list of available titles includes *Aircraft Engines* (3 films), *Airplane Structures* (7 films), *Aircraft Propellers* (2 films), *Weather — Theory and Structures of Storms* (2 films), *Celestial Navigation* (2 films), *The Weft System of Aircraft Identification, Nautical Astronomy, Aerodynamics* (2 films), etc.

While the films are primarily intended for preflight training, they will be found valuable for general educational use.

♦ Women are needed to guide the planes of America as Air Traffic Controller Trainees. College graduates who would like to prepare for a future in air transportation should contact the local secretary of the U. S. Civil Service Examiners at any first- or second-class post office, or come to Room 1115 of the New Post Office Building, Chicago. These positions pay $2,178 per year while being trained. Chances for promotion are excellent.

♦ A 15-page booklet entitled "Keeping the Blackout Outside Your Home" has been prepared by Miss Myrtle Fahsbender, director of residential lighting at Westinghouse. This publication is a revision of an earlier booklet of the same title, and contains the latest blackout information, including more than a score of drawings and photographs. This booklet has been reviewed and passed by the United States Office of Civilian Defense, and is available from the Illuminating Engineering Department, Westinghouse Lamp Division, Bloomfield, N. J.

♦ The Washburne Trade School, Chicago, Ill., has been designated as an accredited teacher-

(Continued on next page)

To Complete This Picture

ADD A STARRETT TOOL

Add the Starrett Vernier Height Gage and you have a picture that is familiar in war plants throughout America — a picture of dependable accuracy such as is supplied by countless thousands of Starrett Tools and Dial Indicators working for victory.

To Complete Your Training Program

ADD "The STARRETT BOOK for STUDENT MACHINISTS"

It contains practical, straightforward, up-to-the minute information about tools, machines and metal working methods. Available through your Starrett Tool dealer at only 75c per copy.

THE L. S. STARRETT CO., ATHOL, MASSACHUSETTS, U. S. A.

World's Greatest Toolmakers

STARRETT TOOLS

Precision Tools...Dial Indicators...Ground Flat Stock...Hacksaws...Metal Cutting Band Saws...Steel Tapes

FOR INSTRUCTION, TOO... *Industry's Test Instruments*
COST LESS . . . BECAUSE OF THEIR LONG-LIFE DEPENDABILITY!

RELAYS
Sensitive and Power Uses
Current and Voltage Types

SERVICE EQUIPMENT
Tubecheckers, Analyzers, Oscillators, Ohmmeters, Vacuum Tube Voltmeters

LIGHT MEASURING DEVICES
Illumination Meter, Foot Candle Meters, Sight Meter, Exposure Meters

SPECIALIZED TESTING EQUIPMENT
Power Analyzer, Photoelectric Potentiometer, Battery Testing Instruments

PANEL MOUNTING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

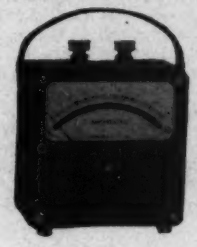
INSTRUMENT TRANSFORMERS
Portable and Switchboard — Potential and Current

PORTABLE INDICATING INSTRUMENTS
Ammeters, Voltmeters, Wattmeters, Galvanometers, Microammeters, Ohmmeters, Microfarad Meters

LABORATORY STANDARDS
Voltmeters, Ammeters, Wattmeters

STANDARD CELLS

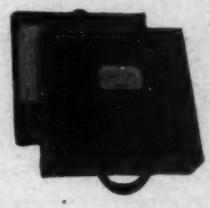
WESTON *MODEL 430*



A-C AND D-C INSTRUMENTS

Ideally suited for classroom instruction and student use because of their dependability, ruggedness and relatively low cost . . . features which have made the Model 430 line so universally preferred throughout industry. Have hand-calibrated mirror scales of long length, with large scale openings. Accuracy within ½ of 1%. Sturdy Bakelite cases give added protection in service. Extremely compact. Available in complete line of A-C and D-C instruments.

WESTON *MODEL 785*



INDUSTRIAL CIRCUIT TESTER

A complete circuit tester for shop or laboratory. Has 27 voltage, current and resistance ranges (d-c voltage sensitivity 20,000 ohms per volt), for checking motor and control circuits, lighting circuits, sensitive relay circuits, communication circuits, etc., etc. Also available with compact resistance tester for checking insulation and cable covering resistance values up to 900 megohms.

WESTON ELECTRICAL INSTRUMENT CORPORATION, 595 Frelinghuysen Avenue, Newark, N. J.

(Continued from previous page)

training institution for in-service training of vocational and technical teachers in the Chicago public school system by the office of the state superintendent of schools.

Dr. William H. Johnson, superintendent of schools, expresses the opinion that, although Chicago is well provided with colleges and universities giving professional training, the high standards of technical training demanded by the Chicago board of education for permanent certification are of such a nature that it appears to be the problem of the Chicago board of education itself to supply a training program for the upgrading of teachers already in the system and also to provide for training for the securing of new certificates, especially for teachers not qualified to teach vocational subjects who are becoming supernumeraries in other subject fields.

The need for this program is becoming more evident day by day, especially at this time when the demands of our armed forces are increasing and the program of vocational education is growing in accordance with these demands. Warnings have been given from all national organizations as to the great shortage of technical teachers throughout the nation, which will be felt even more so after the war, along with the expansion of the vocational rehabilitation and the technical work which will be carried on in schools on the secondary level.

The group of teachers needing immediate attention is that group given certification as trade teachers for such vocational schools as the Washburne, the Dunbar, and the Chicago Vocational School.

♦ As a part of its program for making its facilities available to citizens of the state, Pennsylvania State College, State College, Pa., has established three special library services, namely, *packet libraries, music packets,* and *traveling art displays.*

The *packet library* is an organized assortment of publications that provides a wide variety of material on particular subjects for supplying current and up-to-date references on topical subjects. The average packet contains 20 to 30 separate items, including books, pamphlets, reports, and clippings of current periodicals. Articles are mounted, dated, and labeled so that the borrower may know the source. Material is available on more than 150 different subjects.

Music packets are sample copies of music — a sort of *try-before-you-buy plan* — and are available to responsible groups or organizations for inspection and trial. When the selection is made, additional copies are obtained from publishers who are cooperating with the College Department of Music and with the Extension Library in this service.

Similarly, high school "players," women's clubs, and others may select their play from a drama play packet filled from the 7000 titles on hand in the drama library of the college's Division of Dramatics.

Seven different traveling art displays include reproductions and original prints by old European masters and contemporary American artists. Each display is comprised of from 10 to 24 different pieces, and is mounted for exhibition.

Requests for the special folder in which all the above services are described should be addressed to the Extension Library Services, Room 9, College Library, State College, Pa.

♦ Three recent motion pictures of definite interest to teachers facing the complex problems of vocational guidance in a world at war are announced by Bell & Howell, 1801 Larchmont Ave., Chicago, Ill. The first, "Courtesy Comes to Town," paves the way for the rest of the series, namely, "I Want a Job," and "Minutes Are Pennies." The two latter subjects show courtesy and teamwork directly applied, first to getting a job, and then to holding it. These films may be used singly or as a group.

Answers to Questions

FINISHING SALAD BOWLS

1098. Q.: Since I have a collection of woods from many countries I am hoping to turn small bowls from them, using the bowls as popcorn bowls. Since this involves grease, washing with soap of some form, the ordinary type of finish is of no value. Would you suggest a finish that would possibly be satisfactory under these diverse conditions, and with woods of many kinds.

I have heard that boiling in paraffin oil gives good results. Also some say just rubbing on paraffin oil is satisfactory. Is there any information that is reliable on the use of paraffin oil, and where can it be bought so as to be sure of what you buy? — *O. A. O.*

A.: Under no circumstances should paraffin oil, or any of its derivative types be used as wood-finishing materials. Such oils are nondrying mineral oils, have practically no water resistance, are not able to produce a finish of any kind, do get very soiled in a short time and in all respects are totally unsuited for the purposes of this inquiry.

Contrasted with this material is the newer form of wood preservative or wood penetrating finish as made by DuPont under the trade name of "Penetrating Wood Finish," much used in the finishing of hardwood floors for which it is outstanding.

Have all turned work carefully sanded smooth and free of sanding or tool marks. Stain as desired with water soluble stains. Let dry at least four hours at room temperature. Apply a coat of well-stirred Penetrating Wood Finish, let set thirty minutes, rag off by hand or under 600 r.p.m. in the lathe. Let dry overnight. Rub clean

(Continued on page 36A)

Industrial Arts and Vocational Education Subscriber's Service

We invite inquiries and questions on all problems relating to the organization, planning, and equipping of your school shops. For equipment and supplies the advertising of manufacturers in this issue will serve as a convenient guide, and your requests to these advertisers will bring immediate response.

Use the post card on this page. It will promptly bring from the manufacturers the information requested. A "keyed" alphabetical list of supplies and equipment is given for ready reference and your convenience. Insert the key number of any products in which you are interested, sign, detach, and mail the card—no postage is required if mailed in the United States. *For items of equipment or supplies not included in list please write us a special letter; or include item after "Remarks" on post card, as we can put you in touch with all sources of supply.*

This service is limited to supervisors, shop instructors, and officials responsible for the specification and purchase of equipment and supplies in school shops.

KEYED PRODUCT CHECKING LIST FOR SOURCES OF SUPPLY

If You Desire Catalogs, Information, or Have Any Questions On Two or More of These Products Write the "Key Number" On the Post Card, Sign, and Mail to Us.

1—Abrasives, Cloth—Belt
2—Abrasives, Grain
3—Abrasives, Paper
4—Abrasives, Waterproof
5—Acid Swabs and Brushes
5a—Air Compressors
5b—Airplane Cements and Dopes
6—Aluminum, Bars, Sheets
7—Aluminum, Oxide Cloth
8—Ammeters
9—Anvils
10—Anvil Tools
11—Aprons, Shop
12—Arbor Presses
12a—Arc-Welding sets and equipment
13—Archery Equipment and Supplies
14—Art Metal Tools
15—Asbestos Soldering Blocks
16—Auto Mechanics' Tools
16a—Automotive Test Equipment
17—Auto Trailer Plans and Parts
17a—Axes
18—Babbitt Metal
19—Band Saws
20—Band Saw Blades
21—Band Saw Brazers
21a—Band Saws, metal cutting
22—Band Saws, Portable
23—Band Saw Sets
24—Bar Iron
25—Basketry Supplies
26—Battery Chargers
27—Belting
28—Benches
29—Bench Legs, Metal
30—Bench Metal
31—Bench Stones
32—Benches, Manual Training
33—Benches, Stake Plate
34—Bench Vises
35—Blackboard Drawing Sets
36—Blacksmiths' Tools and Supplies
37—Blowers and Compressors, Air
38—Blow Pipes, Brazing, Jewelers'
39—Blowtorches
40—Blowers, Forge
40a—Blue-Print Cabinets
41—Blue-Printing Machines, Electric
42—Blue-Print Paper & Cloth
43—Books (Specify Subject)
44—Bookbinders' Supplies
45—Borers, Wood
46—Braces and Bits
47—Brass, Sheets, Bar
48—Brass Furnaces, Gas
49—Brazing Torches
50—Bristol Board
50a—Brittania Metal
51—Bronze Sheets, Bars, etc.
52—Brushes, Artists'
53—Brushes, Circular, Bristle and Wire (All Kinds)
54—Brush Conditioner, Paint
55—Brushes, Paint and Varnish
56—Brush Making Materials
57—Buffers, Bench, Pedestal
58—Buffs, Polishing
59—Bushing Removers
59a—Burners—Bunsen or Laboratory
60—Cabinet Hardware
61—Cabinets, Filing
62—Cabinets, Storage (State Kind)
63—Calipers
64—Cane for Chairs
64a—Carving Machines, Wood
65—Carving Tools (Specify Kind)
66—Casting Outfits
67—Castings, Project
68—Carved Wood Moldings
69—Cements, Jewelers'
69a—Cement, Keene's
70—Ceramics
70a—Chairs, Folding
71—Charcoal Blocks
72—Charts
73—Chasing Tools
74—Chisels (State Kind)
75—Chucks, Independent, Universal, Combination
76—Chucks, Drill
77—Circular-Saw Benches
78—Clamps
79—Clamps, Bar
80—Clay, Natural
81—Clock Movements
82—Conduits
83—Coping Saws
84—Coping Saw Blades
85—Copper, Sheets, Bars
86—Core Ovens
87—Countersinks
88—Crucibles
89—Cut-off Saws
90—Cutter Heads
91—Cylinder Printing Presses
92—Dado Heads
93—Decalcomania
94—Desks, Teachers'
95—Die Makers' Supplies
96—Dowel Pointers
97—Doweling Jigs
98—Drafting Tables
99—Drafting Instruments
100—Drawing Inst. Repair Parts
101—Drawing Boards
102—Drawing Paper — Equipment and Supplies (State Kind)
103—Draw Plates
103a—Drilling Machines
104—Drill Presses
105—Drill Sharpeners
106—Drill Stands, Bench, Post, Pedestal
107—Drills
107a—Duplicators
108—Dynamometers, Electric
109—Electric Generators
110—Electric Motors, Power Units
111—Electric Motors, Construction Sets
112—Electrical Instruments
112a—Electric Multi-Meters
112b—Electric Oscillators
113—Electrical Parts and Supplies
114—Emery Paper, Cloth and Powder
114a—Emery Wheel Dresser
115—Enamels
116—Engravers' Tools and Supplies
117—Envelopes
118—Exposure Meters

The School Shop Service Bureau will save your time and the expense of writing to individual firms to establish convenient and reliable sources of supply. We urge the use of this Service Bureau. Additional cards may be had on request.

INFORMATION WANTED

We are interested in the following items as checked below, and will appreciate receiving the information requested, promptly.

☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐

(Check) Catalogs.....Prices.....Information.....Manufacturer's Address....

Remarks: .....

Name .....
Please Print

Title ..... School .....

City ..... State .....

Point Park Library

Keyed Product Checking List for Sources of Supply: Continued

118a—Fasteners, staple
119—Felt, Cloth
120—Felt Wheels and Buffs
121—Fiber Cord
122—Files and Rasps
123—Filing Machines
123a—Films
124—Finishing Kits
125—Fire Brick and Cement
126—Fire Clay
126a—First Aid Kits and Materials
127—Flasks
128—Flexible-Steel Tape Rules
128a—Flexible Shaft and Motor Outfits
129—Flexible Tubing
130—Flint Paper
130a—Flock and Flock Guns
131—Floor Sanders
132—Flux, Soldering
133—Forges, Gas
134—Foundry Supplies and Equipment
135—Frequency Meters
136—Furnace Linings
137—Furnaces, Annealing, Case-Hardening, Heat-Treating, Metal Melting
138—Furniture Finishes and Supplies
139—Furniture Trim
140—Furniture Weaving Frames
141—Fuses, Standard
142—Galvanometers
143—Garnet Papers
143a—Gas Welding equipment
144—Gauges, Printing, Cabinet, Rule and Square
145—Gauges, Wire, Etc.
146—Generator Test Benches
147—Glass Cutter
147a—Glazing tools
148—Glue
148a—Glues—Model Airplane
149—Glue Pots
150—Gouges
151—Grinders and Buffers
152—Grinder Attachments
152a—Grinders, Bench
153—Grinding Compound
154—Grinding Wheels
155—Grinding Wheel Dresser
156—Hacksaws
157—Hacksaws, Power
158—Hacksaw Power Blades
159—Hammers
160—Handicraft Supplies Oxyacetylene
161—Hand Screws
162—Heat-Treating Equipment
163—Hinges
164—Inks, Drawing and Colored
165—Inks, Printing
166—Inlays
167—Jewelers' Tools and Supplies
168—Jig Saws and Blades
169—Jointers, Bench
170—Jointers, Hand
170a—Keene's Cement
171—Kits, Projects
172—Kits, Metal Projects
173—Knife Grinder
174—Knives, Sloyd, Manual Training, Stencil and Wood Block
175—Knives, Machine
175a—Knives, band
176—Knock-Down Furniture
177—Kraftsmen Kits
178—Laboratory Standard Instruments
179—Lacquers
180—Lamps, Alcohol
181—Lamps, Miniature
182—Lathe Attachments
183—Lathes, Metalworking
183a—Lathes, Metal Spinning
184—Lathes, Woodworking
185—Leather-Working Tools and Supplies
186—Letters and Figures for Stamping Metals
187—Levels
188—Linoleum Blocks, Supplies
189—Looms
190—Lumber
191—Machine Lights
191a—Machinists' Tools
192—Mallets
192a—Manual Training Tools and Supplies
193—Metal Craft Tools and Supplies
194—Metal Shears, Electric
195—Metals, Sheet
196—Metal Spinning Equipment
197—Mica
197a—Micrometers
198—Milling Machines
199—Miter Boxes
200—Model Airplane and Boat Parts
200a—Model Airplane Dopes
201—Modeling Clay
202—Modeling Tools
203—Mortisers
204—Motor Generator Sets
204a—Nippers, Cutting, Jewelers'
205—Ohmmeters, Portable
206—Oilstones, Bench
207—Outlets, Switchboxes
207a—Oxy-Acetylene sets & equip.
208—Paints, Projects Finishing
209—Panel Boards, Electric
210—Pantographs
211—Paper, Drawing and Tracing
212—Paste
213—Pencils, Drawing
214—Pencils, Electric Etching
214a—Pencil Pointers
215—Pens, Ink Shading
216—Pens, Lettering
217—Pewter
218—Picture Frame Moldings
219—Phase Angle Meters
220—Picture Frame Tools
221—Planes, Hand
222—Planers and Surfacers (Wood)
223—Plans and Directions
224—Plastic Wood
224a—Plastic wood solvents
225—Pliers
226—Plywood
227—Porcelain Knobs, Cleats
228—Plastic Materials
228a—Portable Electric Drills
229—Portable Meters, Indicating
230—Portable Woodworking Machinery
231—Pottery Supplies
232—Presses, Veneer
233—Power Hack Saws
234—Printshop Equipment and Supplies
234a—Project Service
235—Protractors
236—Punches
237—Radio Parts
237a—Radio Test Equipment
237b—Radio Tube Testers
238—Reeds and Raffia
239—Resistance Boxes, Plug and Dial Resistors
239a—Revolution Counters
240—Rheostats
241—Routers
242—Rubber Stamps
243—Rubber Type Sets
244—Rules, Wood, Boxwood, and Combination
245—Sanders (State Type)
245a—Sanders, Belts
246—Sanders, Portable
247—Sanding, Discs
248—Sandpaper
249—Saws, Circular
250—Saw Filing Machines
251—Saw Sets
252—Saw Trimmers (Printing)
253—Saws
254—Saws, Portable Electric
255—Scrapers, Hand and Cabinet
256—Screw Clamps
257—Screw Drivers
258—Scroll Saws
259—Semi-Precious Stones
260—Shapers, Electric
261—Shapers, Metalworking
262—Sharpening Stones
263—Sheet-Metal Tools and Equipment
264—Shear Grinder
264a—Silversmith's Tools and Supplies
265—Slide Rule
266—Sloyd Knives
267—Sockets and Receptacles
268—Soldering Coppers
269—Soldering Furnaces
269a—Soldering Irons, Electric
270—Solders, All Kinds
271—Special Auto Mechanics' Tools
272—Spindle Carver
273—Spray Painting Equipment
273a—Spray Painting Booths
274—Squares
275—Stains
276—Stakes, Arts and Crafts
277—Steel, Sheets, Bar, Stainless
278—Stencils—Marking
279—Stencils—Silk Screen Process
280—Starters, Motor, Electric
281—Steel Rules
282—Steel Squares
283—Stencil Knives
284—Stools
285—Storage Battery Testing Instruments
286—Switchboards
287—Switchboxes
288—Switches, Safety
288a—Tables, Steel
289—Tachometers, Electric
290—Tacks, Thumb, Steel, Brass
290a—Tackers
291—Tape, Measuring
292—Taps and Dies
293—T Squares
294—Tenoners
295—Thermometers
296—Test Equipment, Electrical
297—Tongs
298—Tool Boxes
299—Tool Charts
300—Tool Checks
301—Tool Post Grinders, Electric
302—Tool Grinders
303—Tool Holders
303a—Tool Stands
303b—Tool Storage Equipt.
304—Torches, Alcohol, Gasoline
305—Transformers
306—Universal Saw Benches
307—Upholstery Materials and Supplies
308—Valve Regrinders
309—Valve-Spring Compressors
310—Variety Saw Benches
311—Varnish and Stains
312—Veneers
313—Vises, Metalworking
313a—Vises, Saw
314—Vises, Woodworkers
314a—Visual education
315—Voltmeters
316—Waterproof Abrasive Papers
317—Wattmeters
318—Weaving Materials, Furniture
319—Welding Equipment, Electric
320—Welding Equipment, oxy-acetylene
321—Wheel Pullers
322—Wood Carvings
323—Wood Dyes
323a—Wood Forms
324—Wood Trimmers
325—Wood-Turning Lathes
326—Woodworking Shapers
327—Woodworking Tools and Supplies (State Kind)
328—Wrenches

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*Note: These books have been listed in Leaflet No. 68 issued by U. S. Office of Education

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(Continued from page 34A)

and smooth with 2/0 steel wool pad either by hand or in the lathe under slow power. Dust off and recoat, let set 15 minutes, rag off clean, let dry overnight. Rub with a pad of 2/0 steel wool in which has been folded a tablespoon of floor wax. This makes a combination wax and polish operation which is done simultaneously. If done in the lathe, watch carefully to avoid cutting through. Finish by polishing dry with a clean cotton flannel cloth pad. The finish is permanent, can be washed with soap and water, is not affected by greases. It can be brought up to a bright polish at any time by a fresh coat of wax. — *Ralph G. Waring.*

New Publications

Fundamentals of Shopwork

By William H. Johnson and Louis V. Newkirk. Cloth, 200 pages, 8⅜ by 11¼ in., illustrated. Price, $1.32. Published by The Macmillan Co., New York, N. Y.

This book gives the learner an insight into the various types of hand and power tools used by the woodworker, the metalworker, the electrician, and the processes which the mechanics in these fields must be able to perform in order to do their work.

The book follows the outline prepared by the War Department.

Helical Milling

By C. A. Felker and H. W. Paine. Paper, 86 pages, 5⅞ by 8¾ in., illustrated. Price — cloth, $2; paper, $1. The Bruce Publishing Company, Milwaukee, Wis.

The milling-machine operator who really wants to be master of his machine must know all of the intricacies involved in computing the change gears and the angular shifting of the geared milling-machine table.

He can learn all about this by studying this small 86-page book.

Carpentry and Joinery Work

By Nelson L. Burbank. Cloth, 248 pages, 8½ by 11¼ in., illustrated. Price, $4. Published by Simmons-Boardman Publishing Co., New York, N. Y.

This is the fourth edition of this book. Its contents have been completely rearranged and most of the original illustrations have been redrawn.

Two new chapters, the one on garage doors and the other on installation of insulation, have been added.

A set of blueprints for a house accompany the book.

Materials of Construction

By Verne C. Fryklund and Charles H. Sechrest. Cloth, 276 pages, 5¾ by 8½ in., illustrated. Price, $2.75. The Bruce Publishing Company, Milwaukee, Wis.

The authors of this book have succeeded in covering a wide variety of materials in a very thorough, yet concise manner.

The book is divided into five parts, which treat of iron and steel, ceramics and plastics, finishing materials, forest products, and other products or materials.

The last mentioned part, treating as it does of abrasives, aluminum, asbestos, copper, brass, bronze, glues, inks, leather, petroleum, and solder, gives a coverage which makes the book useful in other classes besides those ordinarily placed under the caption of school-shop classes. For shop classes, of course, the book fills a real need with its detailed information about the material with which the student actually works.

(Continued on page 41A)

INDEX TO HANDICRAFTS MODELMAKING AND WORKSHOP PROJECTS SUPPLEMENT

By ELEANOR C. LOVELL AND RUTH M. HALL

This supplement is offered in answer to requests from public libraries and industrial art schools for use in locating the many and more up-to-date projects published since the original publication in 1936. It indexes books and periodicals published during the past five years.

"Here is a publication which the handicraft hobbyist, the school teacher, the occupational therapist have long been wanting — a complete index of plans for 'things to make and things to do,' with references to the many periodicals and books containing these plans which are commonly found in public libraries.

"Suppose that you want to make a table, a gun cabinet, or a footstool; or you wish to study techniques of etching, engraving, or textile printing. Anyone who has looked through book after book, periodical after periodical, in search of plans or information pertaining to his project (as has this writer) will understand and appreciate the short cut provided by this Index.

"For the shop instructor, the Index is especially valuable. The proper selection of projects for boys to make is vital to successful instruction. Student interest in the manipulative processes involved and in the objects as completed is one of the principles of good teaching. In addition, the manipulative processes to be taught must be present in the construction; the style or design must be appropriate to these needs; and the cost of the materials must be within the student's means. Therefore, the shop teacher requires a rich background of source material from which the student, with teacher guidance, may select his projects.

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Clifford K. Lush
Supervisor of Industrial Arts Education,
Minneapolis Public Schools,
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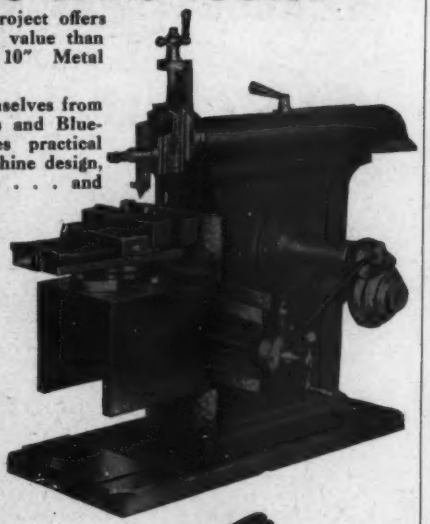

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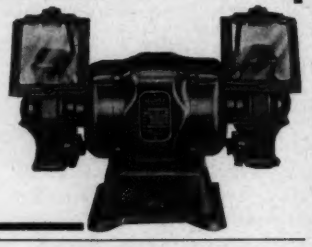

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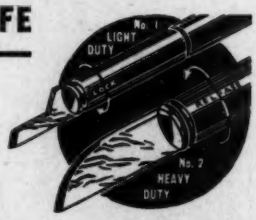

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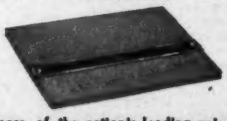

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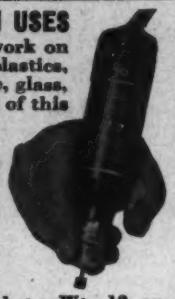

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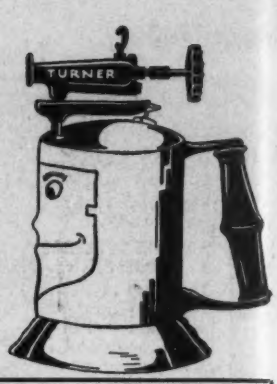

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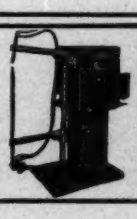

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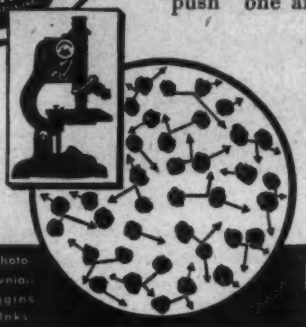

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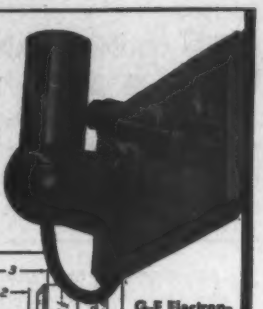

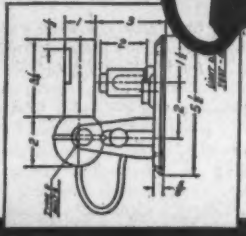

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American Art Clay Company 42A
American Gas Furnace Co. 42A
American Technical Society 35A
Armstrong Bros. Tool Co. 4A
Atkins and Company, E. C. 14A
Atlas Press Company, The 2A
Badger-American Electrotype Co. 42A
Baldor Electric Company 40A
Behr-Manning Corporation 24A
Black & Decker Mfg. Co., The 3A
Boice-Crane Company 27A
Bradley Polytechnic Institute 38A
Bradley Washfountain Co. 30A
Brodhead-Garrett Co. 31A
Bruce Publishing Company, The ..... 3rd cover
Burrill Saw & Tool Works 10A
Campbell Co., M. L. 39A
Carborundum Company, The 5A
Carter Div., R. L. 24A
Casein Company of America 44A
Ceramic Atelier 42A
Chicago Wheel & Mfg. Co. 41A
Cincinnati Tool Company, The 12A
Columbian Vise & Mfg. Co. 8A
Delta Mfg. Company 21A
Dietzgen Company, Eugene ..... 2nd cover
Dixon Crucible Co., Joseph 20A
Driscoll & Co., Martin 42A
Dumore Company, The 22A
Eisler Engineering Co. 42A
Engineering Sales Company 40A
Faxon Company, F. W. 36A
Foley Lumber Company, T. A. 42A
Foley Manufacturing Co. 14A
Franklin Glue Company 10A
General Finishes Sales & Serv. Co. 35A
Gill Products Co., Inc. 41A
Guillow, Paul K. 38A
Heller Bros. Company 26A
Hammett Company, J. L. 42A
Higgins Ink Co., Inc. 43A
Hobart Brothers Company 43A
International Textbook Co. 38A
Jam Handy Organization 23A
Johnson Gas Appliance Co. 6A
K-D Manufacturing Company 28A
LeBlond Machine Tool Co., R. K. ..... 4th cover
Lewis Machine Tool Co. 39A
Lufkin Rule Company, The 8A
Lussky, White and Coolidge 40A
Manual Arts Press 41A
Marquette Manufacturing Co. 40A
McGraw-Hill Book Co., Inc. 14A
Metal Crafts Supply Co. 43A
Millers Falls Company 10A
Morgan Vise Company 6A
Mummert-Dixon Co. 40A
Nicholson File Company 16A
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Red Chief Industries 44A
Rocky Mt. Teachers Agency 43A
Ronald Press 44A
Russell Electric Company 42A
Russell-Jennings Mfg. Co. 39A
Schollhorn Co., Wm. 36A
Sheet Metal Publication Co. 42A
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Stanley Electric Tool Div. 4A
Stanley Tools 6A
Starrett Co., L. S. 33A
Sta-Warm Electric Co. 42A
Sterling Wheelbarrow Co. 43A
Stout Institute, The 38A
Tannewitz Works, The 32A
Tegge Lumber Co., The 40A
Tester Chemical Company 29A
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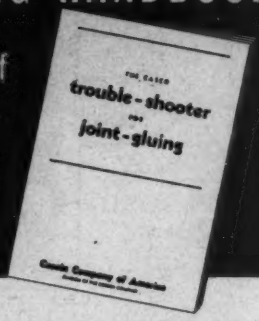

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